8. HYDROGEOLOGY

8.1 Introduction

This chapter of the EIAR describes and assesses the potential impacts of the proposed development on hydrogeology (groundwater). It identifies the potential for effects on groundwater resources and receptors associated with the proposed development. The existing environment is described, mitigation measures are proposed, and the predicted residual impacts are described in the following sections.

8.1.1 *Scope of Assessment*

The scope of the impact assessment and methodology pertaining to hydrogeology is as follows:

1. Establish the baseline hydrogeological conditions relevant to the development site;
2. Identify the potential impacts of the proposed development on the receiving hydrogeological environment;
3. Determine the significance of any identified effect;
4. Develop mitigation measures to reduce or eliminate the impacts; and
5. Identify any residual impacts after mitigation measures are implemented.

8.1.2 *Methodology*

The assessment methodology included desk based studies, site visits, groundwater monitoring and a qualitative assessment of the potential impacts.

Relevant guidelines have been used to inform the preparation and assessment of impacts from the proposed development on groundwater, including:

- National Roads Authority (NRA) (2009) Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydro-geology for National Road Schemes and EPA Guidelines – Advice Notes on Current Practice (in the preparation of Environment Impact Statement);
- Department of Housing, Planning and Local Government (DHPLG) (2018) Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment;
- EPA (2017) Guidelines on the Information to be contained in Environmental Impact Assessment Reports – Draft; and
- Institute of Geologists of Ireland (2013) Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements.

Relevant water quality standards have been consulted and used to inform the assessment where relevant, including:

- European Communities (Drinking Water) Regulations 2014 (S.I. No. 350 of 2014).
- European Communities Environmental Objectives (Groundwater) Regulations 2010 (S.I. No. 9 of 2010), as amended in S.I. No. 389 of 2011, S.I. No. 149 of 2012 and S.I. No. 366 of 2016;

- European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009) as amended by S.I. No. 327 of 2012, SI No. 386 of 2015 and S.I. No. 77 of 2019.

As discussed further in **Section 8.2**, groundwater beneath the site is of variable quality due to residual contamination associated with the historic industrial fertiliser manufacturing activities and saline conditions due to its coastal location on reclaimed land. As a result, the local groundwater is not a potable water resource. As such, drinking water quality standards are considered less relevant screening criteria.

8.1.3 *Sources of Information*

8.1.3.1 Desk Study

A desk-based study was undertaken to establish baseline groundwater information on the site and surrounding area. Information on geology and soils is provided in **Chapter 6 Land and Soils**. The desk study involved a review of all available information, datasets and documentation sources pertaining to the hydrogeology of the area surrounding the application site. Publicly available information sources have been used to inform and supplement the site specific information gathered to complete this assessment as summarised in **Table 8.1**.

Table 8.1 Outline of Public Data Sources Consulted to Inform the EIAR

Data Source	Information Relevant to the EIAR
Geological Survey of Ireland (GSI) Spatial Resources website	Aquifer classification, recharge estimates and groundwater vulnerability
Ordnance Survey of Ireland (OSI) mapping	Historic mapping to assess infilled areas.
EPA Envision Mapviewer website	Water quality data Water Framework Directive classifications Protected Areas under the Water Framework Directive
EPA Website	Public records of relevant EPA licensed facilities in the area (i.e. Marinochem , Licence P0034-03)
EPA Licence P0028-01 public files	Historic groundwater monitoring results, risk assessments site investigations and closure audits dating from IFI's former use of the site and since the cessation of manufacturing activities on the site
Tidal monitoring data provided by the Port of Cork for Whitegate	Tidal effects on groundwater levels and site lagoon water levels

The EIAR prepared by Belvelly Marino Development Company for the demolition, site infrastructure and utility upgrade works for the wider Marino Point site (planning Ref. No. 19/6783) has also been consulted and groundwater monitoring data collected as part of that project has been used to inform this assessment.

8.1.4 *Assessment Criteria*

8.1.4.1 Evaluation and impact assessment categorisation

The method of impact assessment and prediction follows the EPA (2017) *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports.*

8.1.5 *Legislation context*

The following section sets out the legislative context of the assessment in relation to groundwater quality.

Water Framework Directive (WFD) (2000/60/EC)

The Water Framework Directive (WFD) (2000/60/EC) establishes an integrated and coordinated framework for the sustainable management of water. The WFD, transposed into national legislation in 2003, aims to:

- Prevent deterioration of status for surface and groundwaters and the protection, enhancement and restoration of all water bodies;
- Achieve good ecological status and good chemical status for surface waters and good chemical and good quantitative status for groundwaters;
- Progressively reduce pollution of priority substances and phase-out of priority hazardous substances in surface waters and prevention and limitation of input of pollutants in groundwaters;
- Reverse any significant, upward trend of pollutants in groundwaters; and
- Achieve standards and objectives set for protected areas in Community legislation.

The objective for each groundwater body is to prevent deterioration, maintain high and good status waters, restore waters to at least good status where necessary, and ensure that the requirements of associated protected areas are met.

The assessment will therefore determine the impact in accordance with S.I No.9 of 2010 European Communities Environmental Objectives (Groundwater) Regulations 2010 which gives effect to the WFD.

8.2 Existing Environment

8.2.1 *Site and Project Context*

The proposed site is located on a portion of the former IFI manufacturing site as described in detail within **Chapter 2 Description of the Proposed Development**. Several existing groundwater monitoring wells that were installed during the site's historic use remain intact on the site. These wells are available for current monitoring and historic water quality data is available to inform this assessment.

8.2.2 *Hydrogeology*

The GSI have classified the bedrock underlying the Marino Point area as being a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones (Ll) (**Figure 8.1**). Subsoil permeability has been mapped as being moderate (M) and groundwater vulnerability has been mapped as being High (H) due to the presence of thin subsoil across the site (**Figure 8.2)**. As can be seen from the mapping, the development site has not been classified. This is because it is reclaimed land. Average groundwater recharge in the area has been estimated by the GSI to be 130mm/yr. There are no mapped Group Scheme or Public Supply Source Protection Areas on the site or in the surrounding areas within 2km of the site.

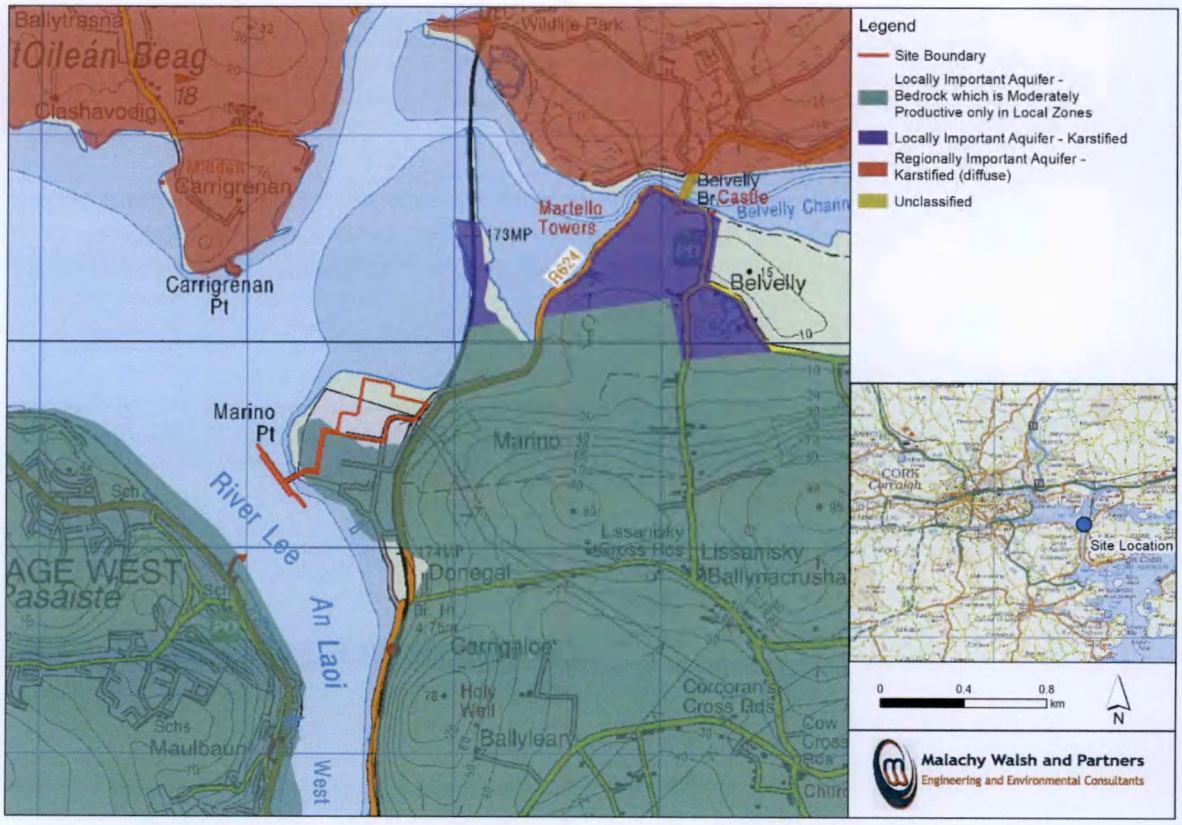

Figure 8.1 Bedrock Aquifer underlying the Marino Point Area

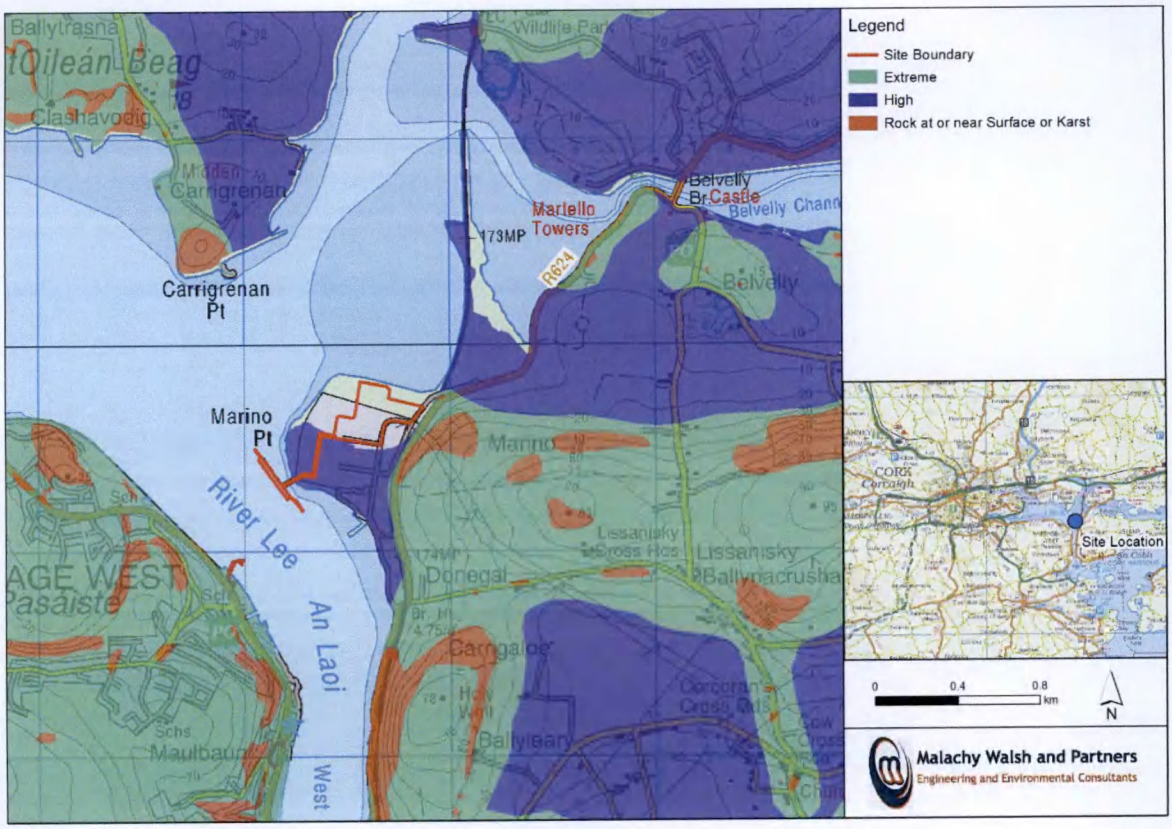

Figure 8.2 Groundwater Vulnerability at the Marino Point Area

8.2.3 *Historic Site Investigations*

As mentioned above, an existing groundwater monitoring network of wells is present across the Marino Point area. These were installed by Irish Fertiliser Ireland (IFI) (95-series and 97- series monitoring wells) under EPA IPC licence number P0028, and for the purposes of due diligence assessment (12-series monitoring wells). Some of these are located on the footprint of the Gouldings development site or in relevant surrounding areas. Refer to **Figure 8.3** below for monitoring well locations that are present and those that have been used in the preparation of this EIAR. These wells remain intact and available for groundwater monitoring purposes in order to assess the current baseline condition.

Figure 8.3 Groundwater monitoring wells in the Marino Point area that have been used to inform the EIAR

Periodic groundwater and soil contamination monitoring and assessments were conducted on the Marino Point site to fulfil EPA licence obligations during the time under which the IPC licence was operational.

Historic reports have also been obtained from EPA licence public records and reviewed to provide information on historic groundwater quality conditions on the site, which provides a useful time series with which to assess potential future trends in groundwater quality at the site.

8.2.4 *Additional Site Investigations*

A walkover survey of the site was undertaken in May 2019 by Mr. Shane Herlihy, project hydrogeologist, to fully assess current baseline groundwater conditions. The following scope of work was completed:

- Topographic levelling of each monitoring well;
- Monitoring of groundwater levels at low tide and high tide with a manual electronic dipper;
- Installation of data loggers in the lagoon in the northern part of the site and at three groundwater monitoring locations over three months to capture seasonal variations in response to rainfall and tidal changes;
- Mapping of groundwater flow directions across the site at low and high tide conditions;
- Collection of groundwater samples from existing wells;

- Field measurement of temperature, pH, electrical conductivity, and dissolved oxygen in groundwater; and
- Laboratory analysis of groundwater for a range of parameters and potential contaminants including Dissolved Inorganic Nitrogen (DIN) species (nitrate, nitrite, ammonium, ammonia), major ions, alkalinity, metals, volatile organic compounds (VOC), total petroleum hydrocarbons (TPH) and polycyclic aromatic hydrocarbons (PAH's).

8.2.5 *Site Specific Hydrogeology*

Groundwater level monitoring conducted on the site in 2019 at low, medium and high tidal stages indicates that groundwater follows the general topographic gradients across the Marino Point area with groundwater flowing to the north and northwest under the northern two-thirds of the area (including the proposed Gouldings site) and groundwater flowing to the south and southwest in the southern third of the site, as illustrated in **Figure 8.4** below (High Tide). Additional groundwater flow mapping at mid-tide and low tide conditions are included in **Appendix 8**, which illustrates a similar pattern of flow.

Figure 8.4 Groundwater Flow Map (High Tide)

Groundwater discharges to Lough Mahon from the bedrock sub-tidally and through the overlying estuarine silts in the intertidal area.

Groundwater level monitoring undertaken in 2019 using continuous data logging equipment (corrected for barometric pressure) from three groundwater monitoring wells indicates a variable

response to tidal influence across Marino Point. This reflects the distance to the shoreline and the variations in ground conditions and depths of borehole installations as illustrated in the time series graphs provided for the following monitoring wells:

- Monitoring well 95-8 (**Figure 8.5**) – is located to the west of the proposed site and illustrates a strong tidal response with 0.4m to 0.6m of tidal change in groundwater levels in response to the tidal changes in the adjacent surface water (Lough Mahon). Tidal responses in groundwater typically decrease with distance from the shoreline, which explains the much lower tidal signal in well 12-1 (refer below) when compared with that of well 95-8.
- Monitoring well 12-1 (**Figure 8.6**) – is located to the south of the proposed site and illustrates a trace tidal response (c. 2cm tidal variation) when superimposed upon a groundwater level hydrograph illustrating the effects of rainfall recharge. The hydrograph responded rapidly (rising by 0.65m) following the heavy rainfall recorded at Met Éireann's monitoring station at Roches Point that measured 49.8mm of rainfall on 15 April 2019.
- Monitoring well 95-3 (**Figure 8.7**) – is located to the northeast of the proposed site and illustrates a trace tidal response (1-2cm) superimposed upon a groundwater level hydrograph illustrating the effects of groundwater recharge. Of note, the effects of well purging during sample collection on 28th of May 2019 illustrate the low permeability of the formation surrounding the monitoring well as it took several days for the groundwater level to fully recover from the effects of sampling. The very low tidal influence at this location when considering its proximity to the shoreline and the lagoon indicates that it is not strongly hydraulically connected to the adjacent surface waters. This is expected to be due to its relatively shallow depth.

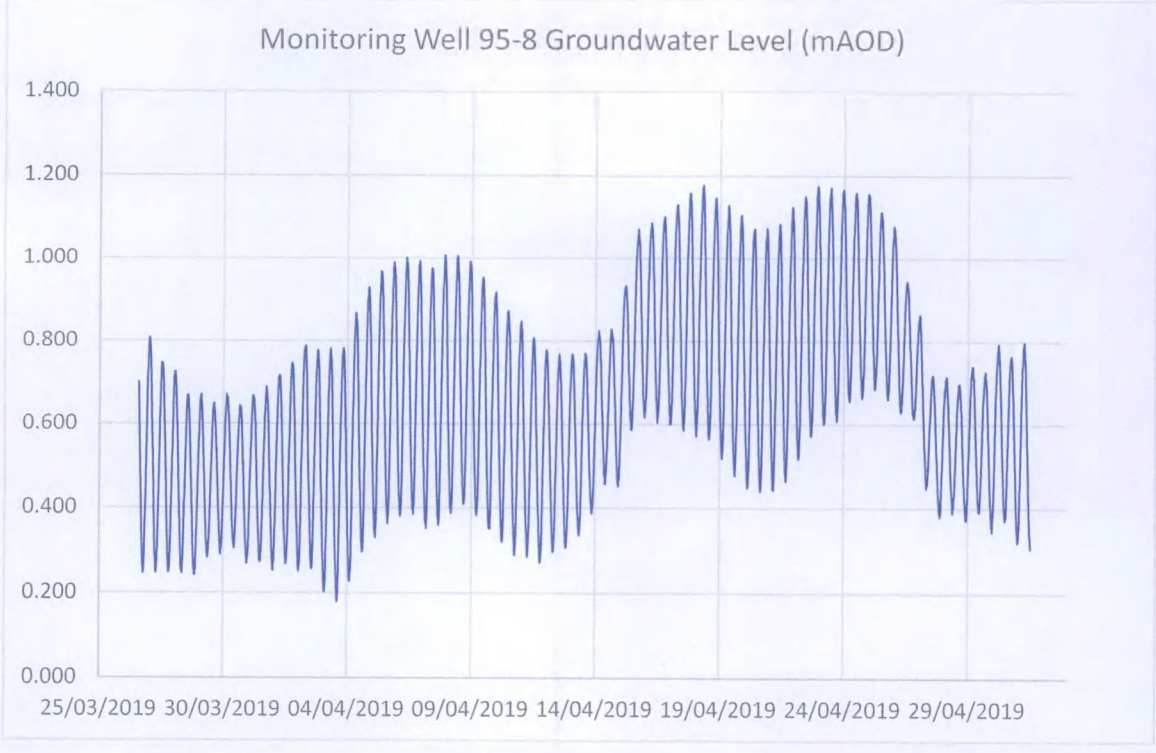

Figure 8.5 Monitoring Well 95-8 Groundwater Level (mAOD)

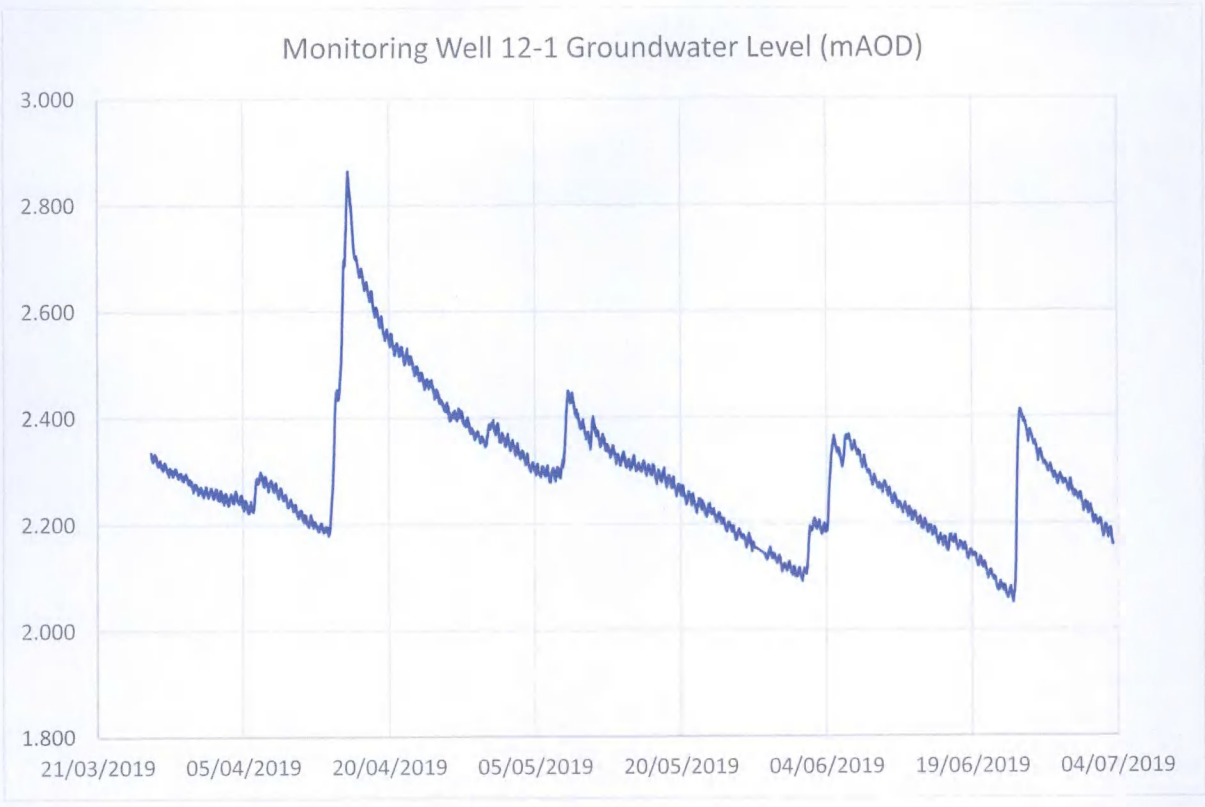

Figure 8.6 Monitoring Well 12-1 Groundwater Level (mAOD)

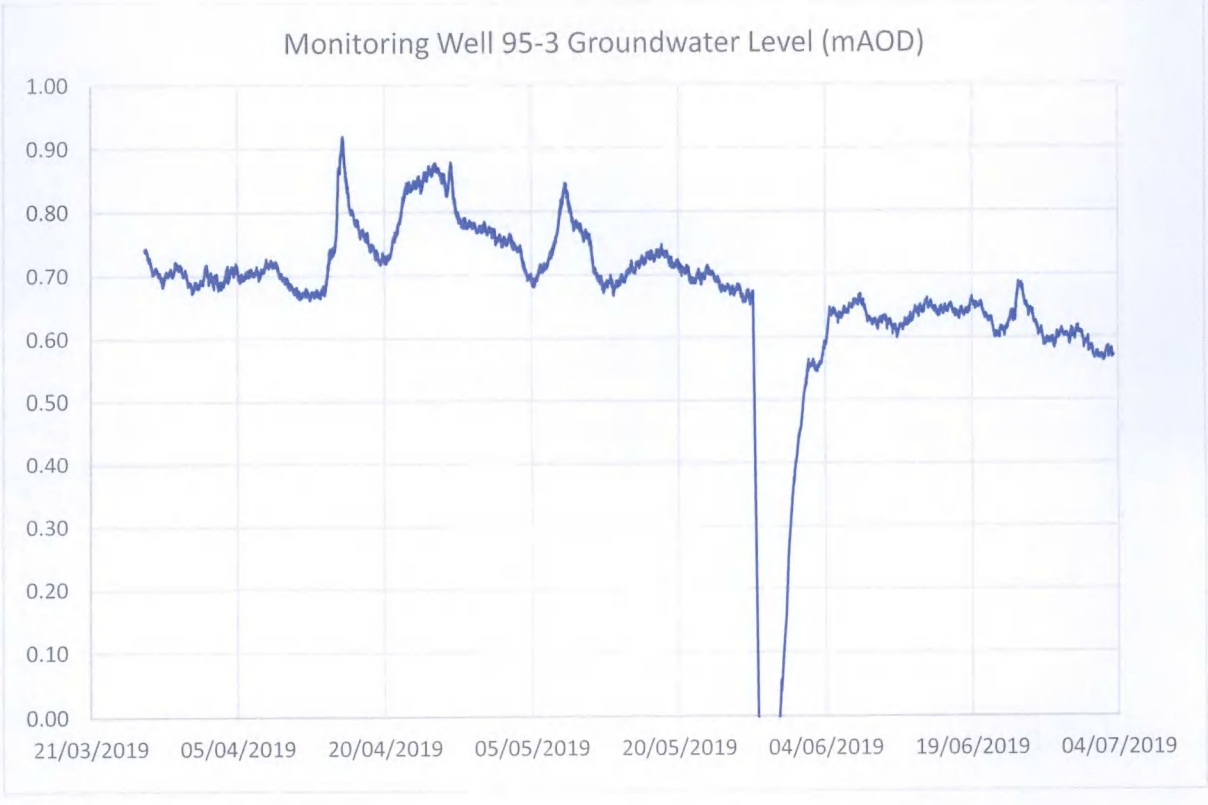

Figure 8.7 Monitoring Well 95-3 Groundwater Level (mAOD)

The strongest tidal influence in groundwater observed in the three monitoring wells that were used to collect continuous water level changes was observed in well 95-8, and these have been compared against tidal water level changes observed at Whitegate in **Figure 8.8**. This indicates a clear correlation with tidal level changes in the adjacent surface water body. The relative change in groundwater levels between low and high tide is also lower than that observed in surface water, which would be expected.

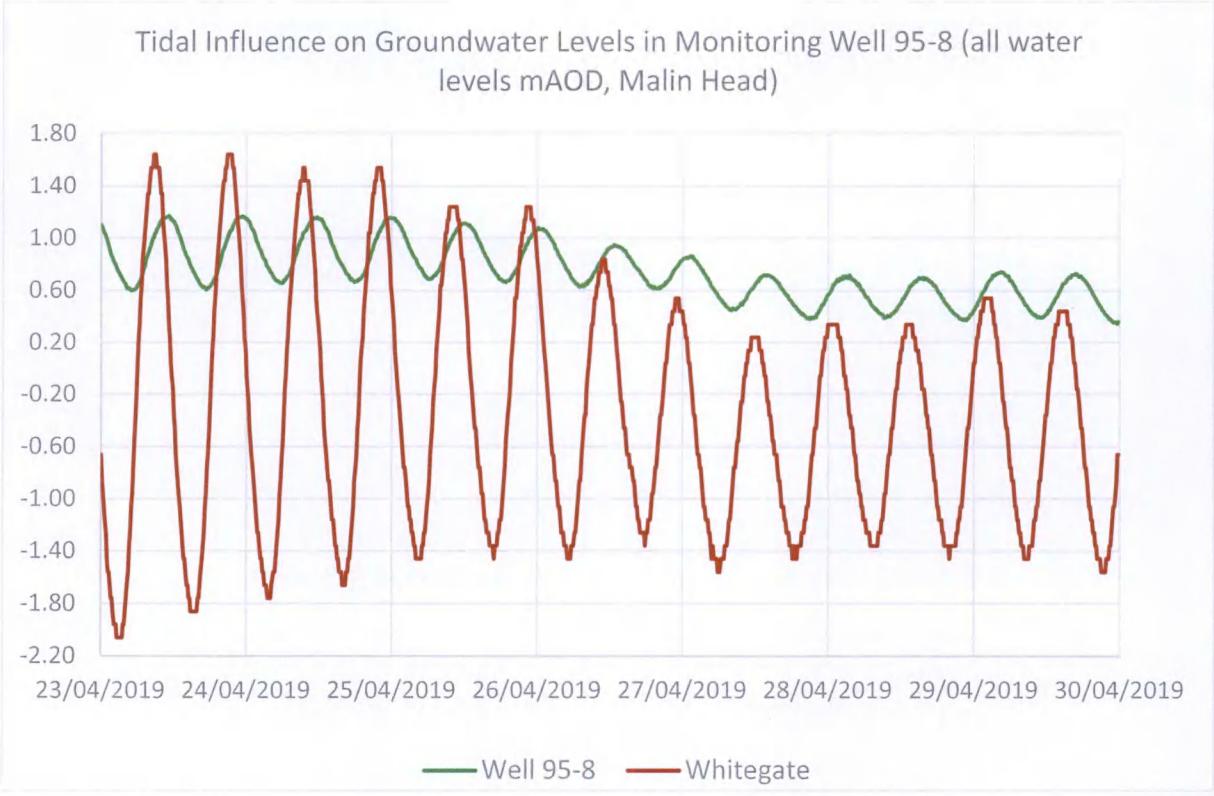

Figure 8.8 Tidal Influence on Groundwater Levels in Monitoring Well 95-8 (all water levels mAOD, Malin Head)

8.2.6 *Water Quality*

8.2.6.1 Surface Water Quality

As groundwater from the site and wider Marino Point area discharges to Lough Mahon, surface water is considered a receptor and its quality and status are discussed in greater detail within **Chapter 7 Hydrology** and summarised in this section. The WFD water quality status of Lough Mahon is Moderate and the objective is to restore to good status by 2021.

A summary of waterbodies associated with the project are summarised in **Table 8.2**.

Table 8.2 Waterbody status for Receiving Waters[1]

Waterbody Code	Waterbody Type	Name	Status	Risk	Objective
IE_SW_060_0750	Transitional	Lough Mahon	Moderate	At Risk	Restore 2021

8.2.6.2 Groundwater Quality

Groundwater quality has been assessed from the collection of groundwater samples for a comprehensive suite of laboratory chemical parameters relevant to the site's historic use as a fertiliser manufacturing facility and consistent with those collected most recently under the former IFI Marino Point EPA licence monitoring requirements in 2017. The laboratory test report and summary tables for all test parameters are included in **Appendix 8.2** and a summary of the groundwater quality results is provided in **Table 8.3** and **Table 8.4** below.

Table 8.3 Field Measured Parameters May 2019

Location	Date	Static Water Level (mbc)	Total Depth (mbc)	Purged volume (l)	Temp (C)	pH	EC (µS/cm)	DO (%)	Notes
95-3	27-May-2019	1.74	5.65	20 *	12.0	8.76	4674.0	77.3	Brown with suspended sediment
95-6	28-May-2019	2.82	9.48	60	13.1	8.28	1709.9	3.9	Clear, stale odour, slight bubbles during purging
95-7	28-May-2019	3.32	11.15	65	12.9	9.30	1422.7	2.7	Clear, no odour, no sheen
95-8	27-May-2019	3.17	17.30	90	16.4	8.76	13628.0	11.7	Clear, H_2S odour, trace grey film
95-9	27-May-2019	0.56	5.10	45	13.0	7.96	455.2	3.6	Clear, H_2S odour, no sheen
12-1	27-May-2019	2.19	10.14	60	13.3	6.83	382.9	13.8	Brown silty fine sand, no odour, no sheen

Groundwater electrical conductivity (EC) varied significantly across the area with conductivities indicative of fresh groundwater in the south and eastern parts of the area (e.g. 382.96 µS/cm at 12-1) and increasing conductivities indicating the increasing influence of saline intrusion to the north and west across the site (e.g. 13,628 µS/cm at 95-8). Groundwater pH also varied across the study area with neutral conditions (e.g. pH 6.83 at 12-1) in wells typically with lower EC and higher pH indicating more alkaline conditions in the northwest of the site corresponding with the higher electrical conductivity and saline influence (e.g. pH 8.76 at 95-8). Dissolved Oxygen (DO) also varied with generally low DO across the study area, with the exception of 95-3, which is considered to reflect the shallow installation of this well. The presence of hydrogen sulphide (H_2S) odours are suggestive of reducing conditions in groundwater, which is consistent with the low DO observed in these locations.

[1] http://watermaps.wfdireland.ie/NsShare_Web/ReportViewer.aspx?reportName=rwb_all&layer=transitional&eu_cd=IE_SW_060_0750

Table 8.4 Summary of Groundwater Chemical Results May 2019

Location		95-3	95-6	95-61 Duplicate of 95-6	95-7	95-8	95-9	12-1
Date	Units	27-May-2019	28-May-2019	28-May-2019	28-May-2019	27-May-2019	27-May-2019	27-May-2019
Bromide	mg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Salinity	ppt	3.8	< 2.0	< 2.0	< 2.0	9.8	< 2.0	< 2.0
Total Dissolved Solids	mg/l	4000	2100	1400	1200	9800	560	330
Alkalinity (Total)	mg/l	560	470	500	920	< 10	220	170
Chloride	mg/l	1900	380	380	71	6300	46	22
Fluoride	mg/l	0.35	5.7	6.0	0.89	0.19	0.29	0.12
Ammonia (Free)	mg/l	11	24	24	55	0.63	1.3	0.73
Ammonium	mg/l	58	93	94	160	16	5.4	5.0
Nitrite	mg/l	< 0.020	< 0.020	< 0.020	4.5	< 0.020	< 0.020	< 0.020
Nitrate	mg/l	1.3	< 0.50	< 0.50	30	< 0.50	< 0.50	2.2
Dissolved Inorganic Nitrogen (DIN)	mg/l - N	54.3	91.8	92.5	177	12.9	5.25	4.97
Phosphate	mg/l	0.41	3.7	3.8	4.3	0.40	< 0.20	< 0.20
Sulphate	mg/l	9.0	67	67	25	290	< 1.0	58
Calcium	mg/l	18	< 5.0	< 5.0	< 5.0	180	44	48
Potassium	mg/l	72	29	31	13	93	5.1	4.1
Magnesium	mg/l	96	3.4	3.4	2.0	410	21	14
Sodium	mg/l	1100	360	340	80	2500	56	44
Arsenic (Dissolved)	µg/l	3.5	6.1	5.4	66	15	9.7	< 1.0
Cadmium (Dissolved)	µg/l	< 0.080	0.22	0.34	< 0.080	< 0.080	< 0.080	< 0.080
Chromium (Dissolved)	µg/l	16	11	9.3	8.0	58	2.8	4.9
Copper (Dissolved)	µg/l	6.6	2.8	1.8	5.7	32	< 1.0	< 1.0
Mercury (Dissolved)	µg/l	< 0.50	< 0.50	0.52	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	µg/l	1.4	< 1.0	< 1.0	8.6	1.6	< 1.0	< 1.0
Lead (Dissolved)	µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Selenium (Dissolved)	µg/l	18	4.5	4.4	1.4	71	< 1.0	< 1.0
Strontium (Dissolved)	µg/l	190	34	22	12	2900	95	64
Zinc (Dissolved)	µg/l	< 1.0	< 1.0	< 1.0	< 1.0	6.2	< 1.0	< 1.0
TPH >C6-C10	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
TPH >C10-C21	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
TPH >C21-C40	µg/l	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total TPH >C6-C40	µg/l	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Total Of 16 PAH's	µg/l	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Volatile Organic Compounds (VOC's)	µg/l	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

The most significant compounds of concern within the groundwater at the site are Dissolved Inorganic Nitrogen species (DIN) which relates to the site's historic use as a nitrogen fertiliser manufacturing facility. In order to assess the relative proportions of nitrogen species present in groundwater, the results have been converted to be expressed in DIN[2] as units of mg/l-N and illustrated in **Figure 8.9**.

[2] Dissolved Inorganic Nitrogen (DIN) – is equal to the sum of all dissolved inorganic nitrogen species (ammonia, ammonium, nitrite and nitrate). In order to calculate DIN, concentrations for each nitrogen species (e.g. ammonia) must be converted to be expressed as mg/l-N prior to their addition to calculate DIN.

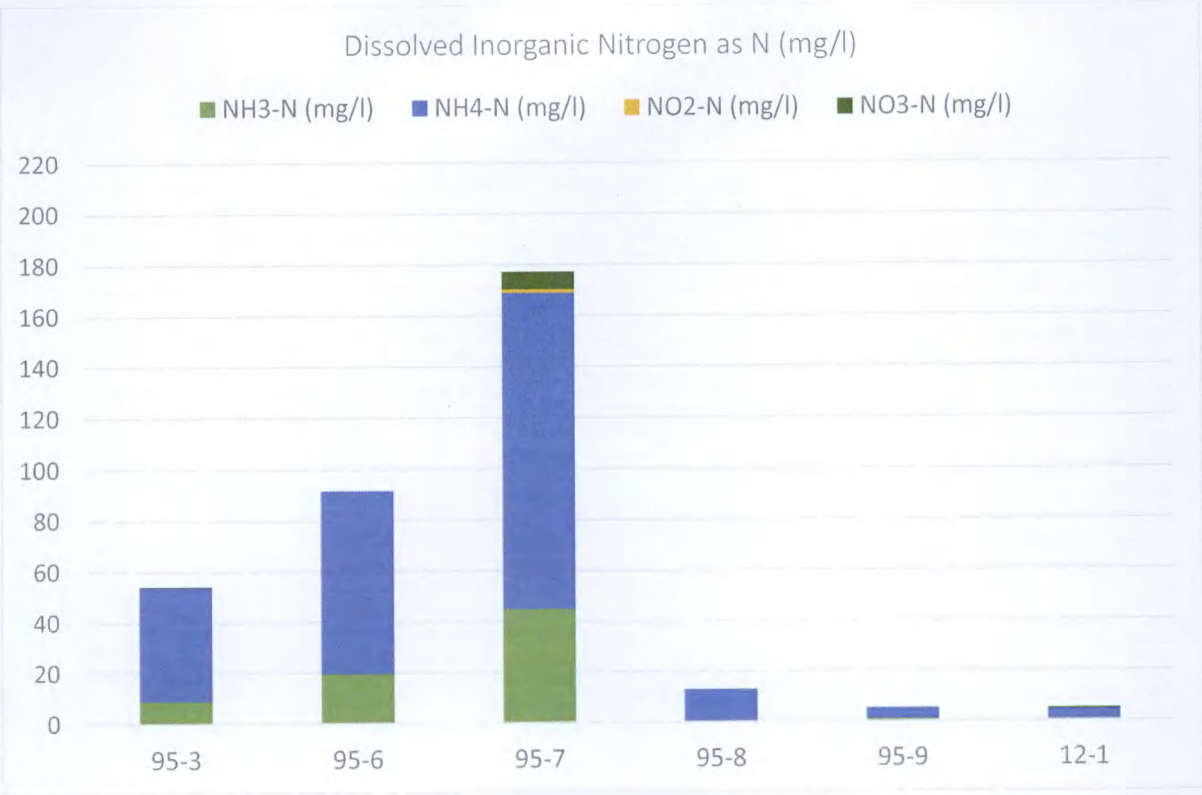

Figure 8.9 Dissolved Inorganic Nitrogen (DIN as mg N/l)

As can be seen, ammonia (NH_4) is the most dominant species, followed by ammonia (NH_3) and to a much lesser extent by nitrate (NO_3).

Spatially, the highest concentrations of DIN are present off site to the south and southwest of the proposed Gouldings site in the central area of the Marino Point site, reflecting the historic storage and manufacturing activities and the direction of groundwater flow.

Although elevated, dissolved nitrogen concentrations in the groundwater have decreased significantly over time since the cessation of the IFI manufacturing activity in 2002 as illustrated in **Figure 8.10** (historic ammonia concentration trends) and **Figure 8.11** (historic nitrate concentration trends). In both cases, concentrations are currently orders of magnitude lower than those reported during the site's historic manufacturing period.

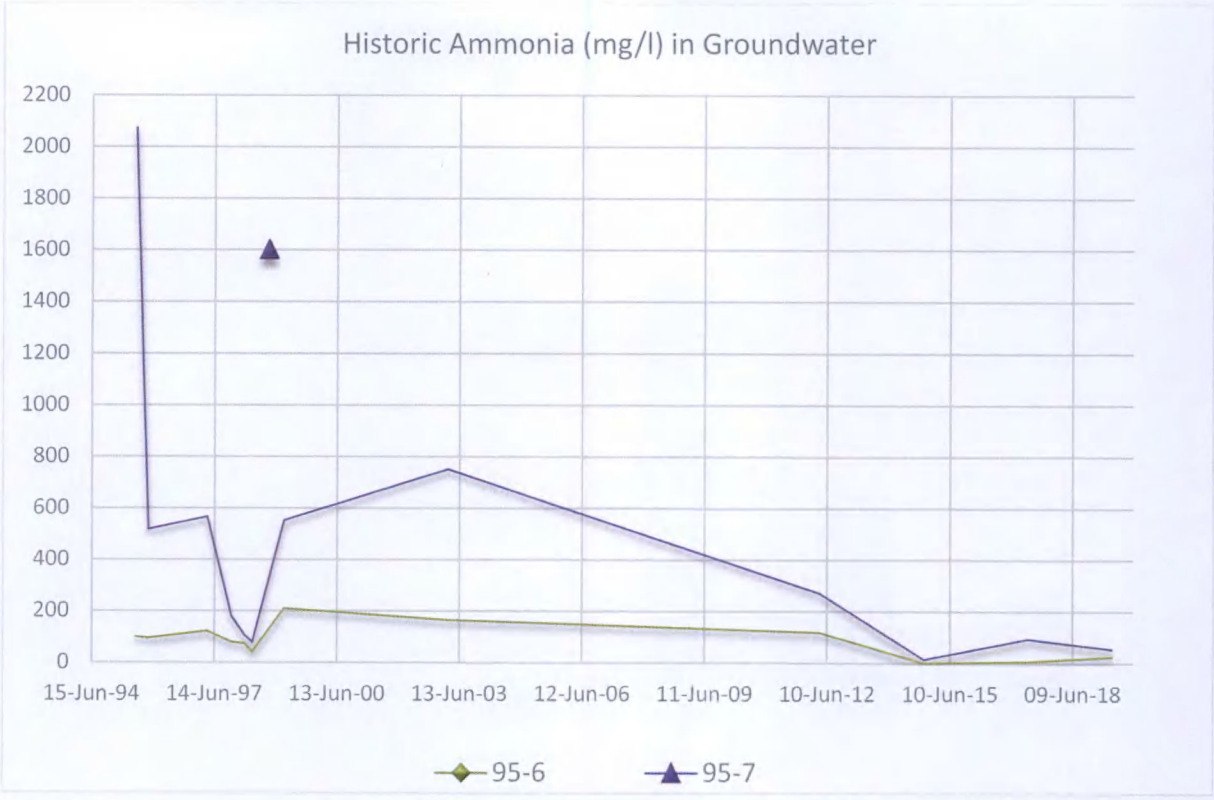

Figure 8.10 Historic Ammonia (mg/l) in Groundwater

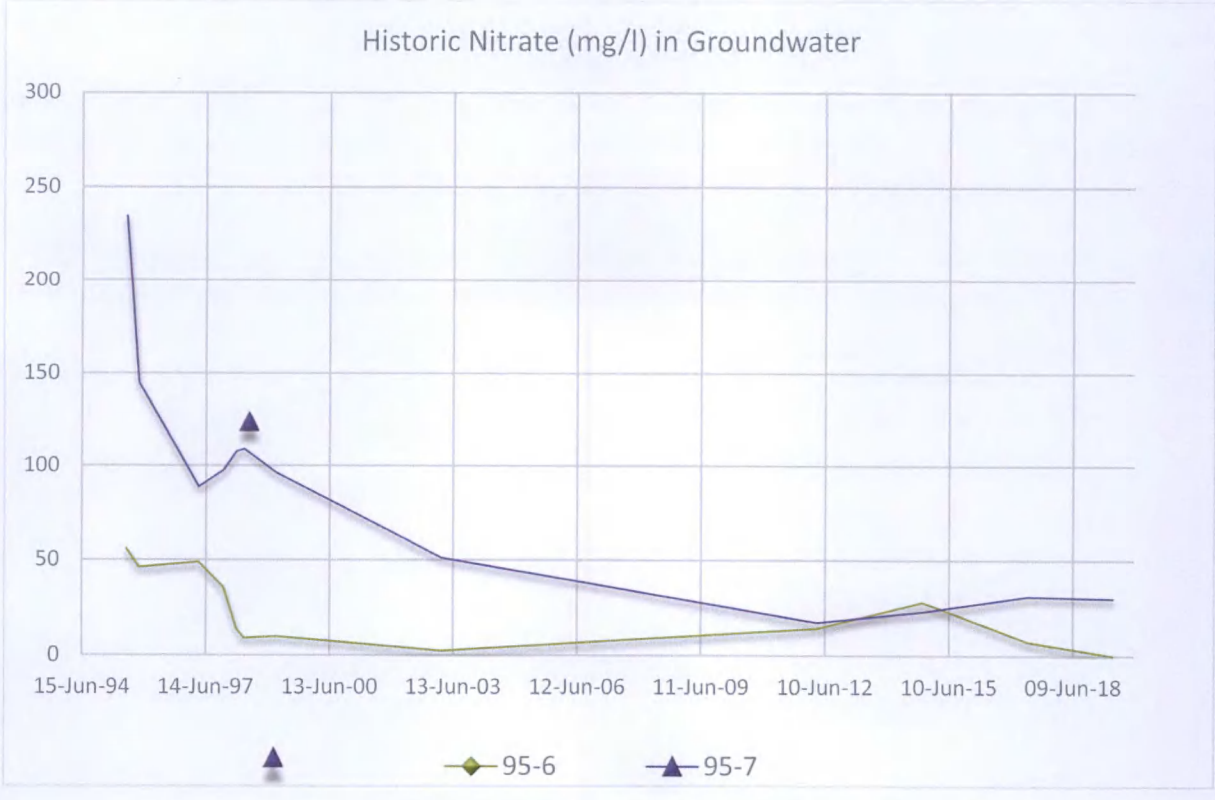

Figure 8.11 Historic Nitrate (mg/l) in Groundwater

9. AIR QUALITY AND CLIMATE

9.1 Introduction

This chapter of the EIAR describes the emissions to the atmosphere that may occur as a result of the proposed agricultural fertiliser facility and additional shipping operations at the Belvelly Port Facility. The Belvelly Port Facility will be developed in phases for various industrial uses. The Belvelly Marino Development Company submitted an application to Cork County Council (19/6783) to stabilise the existing site and provide capacity for future industrial development proposals. The application is currently being considered by An Bord Pleanála. The proposed agricultural fertiliser facility and associated shipping operations will be the first additional industrial use at the Belvelly Port Facility.

Emissions to the atmosphere can have adverse effects on local, regional and transboundary air quality. Emissions of greenhouse gases can adversely affect the global climate.

The purpose of this chapter is to identify, describe and assess the direct and indirect effects of emissions to the atmosphere from the proposed development of the agricultural fertiliser facility and additional shipping operations on air and climate.

This chapter includes an assessment of potential impacts of airborne emissions and provides suggestions to minimise the release of emissions to the atmosphere from activities at the site.

9.1.1 Scope of Assessment

The scope of the air quality and climate assessments include consideration of the following:

- Baseline levels of air contaminants at the Marino Point site without the proposed development.
- A qualitative assessment of potential impacts on air quality from:
  - Construction
  - Operation
- A quantitative assessment of potential impacts on air quality caused by changes to traffic on local roads resulting from the proposed operations at the Belvelly Port Facility
- A qualitative assessment of potential impacts of the proposed construction and operation phases on the climate.
- A qualitative assessment of the potential for cumulative impacts on air quality if the construction phase of planning application 19/6783 overlaps with the construction phase of the proposed development.

9.1.2 Methodology

The assessment has been conducted in accordance with relevant regulatory guidance and has used site representative information, including the following:

- Meteorological data from the nearest Met Eireann site at Cork Airport
- Air quality data from the Environmental Protection Agency's monitoring network at Cobh
- EPA Ireland's Air Dispersion Modelling Guidance Note (AG4) (EPA, 2009)

- EPA Ireland's Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, Draft August 2017 (EPA EIAR Guidelines).
- Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC)
- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011).
- Design Manual for Roads and Bridges (DMRB) Section 11.3 Part 1, published in November 2019 (DMRB LA 105 – Air Quality).
- SEA and Climate change: Integrating Climate Change into Strategic Environmental Assessment in Ireland – Guidance Note (EPA, 2015).

9.1.3 Sources of Information

To assess the potential impacts of the proposed development on air quality and climate, a detailed desktop review was completed. This review aimed to assess baseline air quality, project construction and operational phase activities to determine the likelihood and significance of any emissions to atmosphere.

The following information was considered as part of the desktop assessment:

- EPA air quality monitoring data to characterise baseline air quality at the subject site
- Satellite imagery of Greater Island and Cork Harbour to identify sensitive receptors in close proximity to the site
- Global Information System (GIS) data from the EPA regarding Natura 2000 sites in close proximity to the subject site
- Relevant assessment criteria, guidelines and best practice have been used to assess the potential impact of the proposed development on air quality (at sensitive receptors) and climate
- The construction methodology and its potential for dust generation
- Goulding's operational manual titled: Goulding Fertilisers proposed cargo handling procedures at Belvelly port Facility
- The EIAR, planning application, appropriate assessment and Natura impact statement submitted to Cork County Council for planning application 19/6783
- The Preliminary Construction and Environmental Management Plan (CEMP) submitted with Cork County Council for planning application 19/6783.

9.1.4 Assessment Criteria

9.1.4.1 Climate Change and Policy Context

9.1.4.1.1 Global climate change response

Ireland is a party to both the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, which together provide an international legal framework for addressing climate change. The Paris Agreement is the new legally binding, global agreement addressing climate change under the UNFCCC. The Paris Agreement was adopted by 195 Parties to the UNFCCC, representing 95% of global emissions, at the twenty-first session of the Conference of the Parties to the UNFCCC in December 2015. The ratification of the Agreement by the European Union triggered its entry into force on 4 November 2016, the same date the Agreement was ratified by Ireland. This legally-binding

agreement, represents a global milestone in international efforts to achieve a peaking of greenhouse gas emissions as soon as possible and to achieve net zero emissions by the second half of the century.

Each party to the agreement must commit to a Nationally Determined Contribution (NDC) that shall increase in ambition over time, with progress being tracked by a series of global stocktakes, to be held every five years, starting in 2023. Ireland's contribution to the Paris Agreement will be via the NDC tabled by the EU on behalf of its Member States. The EU as a whole has committed to reducing its greenhouse gas (GHG) emissions by at least 40% by 2030, compared to 1990 levels.

9.1.4.1.2 European Union response

The European Council (EC) is committed to an EU objective of reducing GHG emissions by 80-95% by 2050 compared to 1990. Complimentary to this the EU has adopted interim objectives for 2020 and 2030:

- 2020 – reduce GHG emissions by 20% compared to 1990 levels
- 2030 – reduce GHG emissions by 40% compared to 1990 levels

These objectives will be achieved through a combination of the EU Emissions Trading Scheme (ETS) and individual targets for each EU Member State for non-ETS sectors. Negotiations on these draft Effort Sharing Regulation (ESR) proposals are ongoing. Complementary to this, the EC's Climate and Energy Framework includes binding targets of 27% renewable energy and an energy efficiency increase of at least 27% across the EU.

9.1.4.1.3 National policy and long-term vision

In 2014, the Government adopted the *National Policy Position on Climate Action and Low Carbon Development (National Policy Position)*. The National Policy Position establishes the fundamental national objective of achieving transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050. It sets out the context for the objective, clarifies the level of greenhouse gas mitigation ambition envisaged and establishes the process to pursue and achieve the overall objective. Specifically, the National Policy Position envisages that policy development will be guided by a long-term vision based on:

- An aggregate reduction in carbon dioxide (CO_2) emissions of at least 80% (compared to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors
- In parallel, an approach to carbon neutrality in the agriculture and land-use sector, including forestry, which does not compromise capacity for sustainable food production.

With 2015 GHG emission as a starting point, this equates to average annual reductions of 0.75MtCO_2, compared to the projected position in 2035, which would require average annual reductions of almost 2 MtCO_2 which highlights the need for earlier action. The White Paper on Energy Policy, *Ireland's Transition to a Low Carbon Energy Future 2015-2030* recognises that a radical transformation of Ireland's energy system is required to meet national, EU and international climate objectives and sets a course for an energy sector where the State will provide the supports that enable consumers to become active energy citizens. The vision is to reduce GHG emissions from the energy sector by between 80% and 95% compared to 1990 levels by 2050, while ensuring that secure supplies of

competitive and affordable energy remain available to citizens and businesses. The White Paper sets out how the energy transition will depend on accelerated and diversified renewable energy generation, and a renewed focus on energy efficiency.

The *Climate Action and Low Carbon Development Act 2015* provides the statutory basis for the national transition objective – the goal of progressively pursuing a low carbon, climate resilient and environmentally sustainable economy by 2050. It provides the legislative framework for the development and submission to Government for approval of national mitigation plans and national adaptation frameworks. This includes the institutional and governance framework for the development of these plans on a regular basis, together with independent advisory and Oireachtas accountability arrangements.

At a national level, Ireland has also adopted the Climate Change Action (CCA) Plan in 2019. The CCA Plan compliments National Policy position and includes provisions of relevance to the management of GHG emissions at a national level:

- Targets of 50% Energy Efficiency and 30% greenhouse gas emissions reduction
- A trajectory for the price of carbon to create incentives which help avoid locking in carbon intensive technologies
- Increased reliance on renewables from 30% to 70% adding 12GW of renewable energy capacity (with peat and coal plants closing) with some of this delivered by private contracts.

9.1.4.1.4 EU commitments

The EU ETS includes approximately 11,000 installations across the EU with 102 installations currently permitted in Ireland. It covers approximately 45% of total EU emissions and 28% of total emissions in Ireland as indicated by **Figure 9.1.**

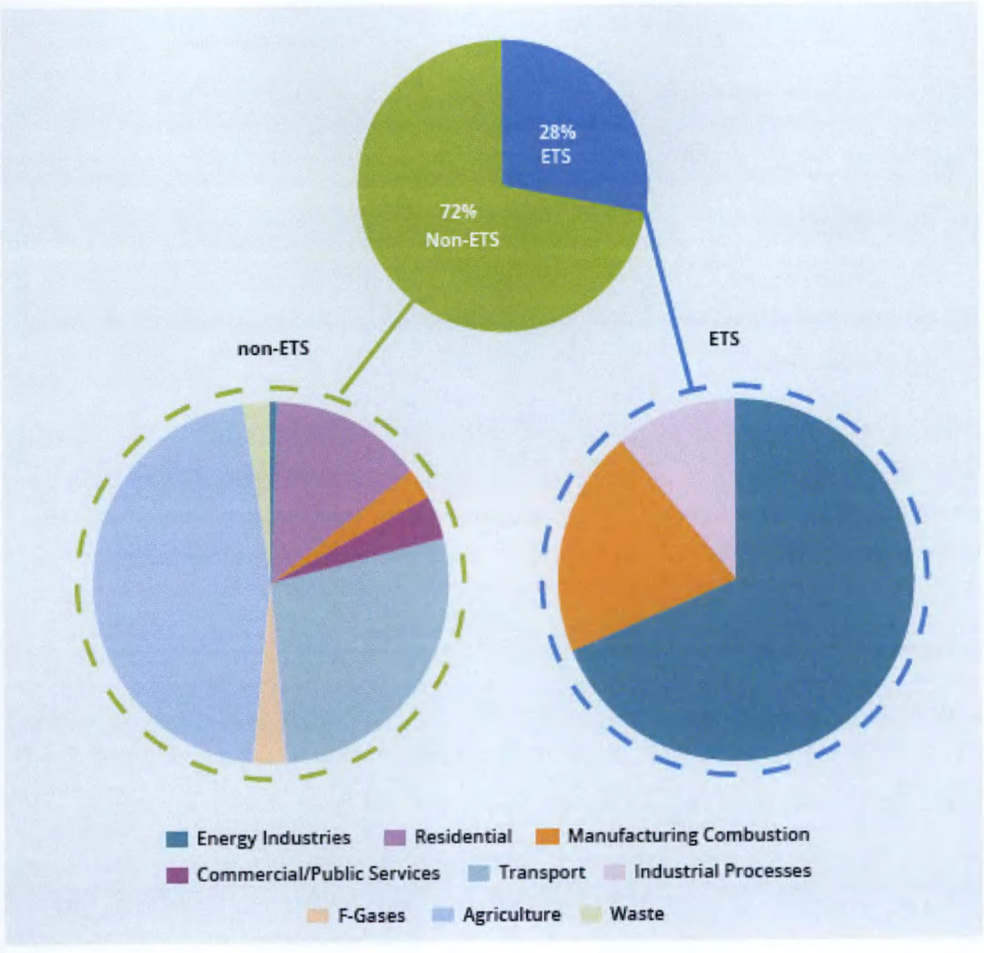

Figure 9.1 Ireland GHG emissions - ETS/non-ETS

The 2009 Effort Sharing Decision set individual Member State targets for non-ETS emissions out to 2020. Under this decision, Ireland has an emissions reduction target for each year between 2013 and 2020. The 2020 target set for Ireland is that GHG emissions should be 20% below their 2005 level.

9.1.4.1.5 Cork – Regional commitments

Cork County Council signed up to the Covenant of Mayors (COM) for Climate and Energy in 2016, a European movement by local and regional authorities to address climate change. In Ireland, the vast majority of energy is consumed in city territories. As a signatory to the COM, Cork city has made a voluntary commitment to transition to a low-carbon society by reducing CO_2 emissions within their territories by at least 40% by 2030. As part of the COM commitment, Cork County Council prepared and submitted the Sustainable Energy and Climate Action Plan (SECAP) in 2018 and has also committed to reporting every 2 years on the implementation of the mitigation and adaptation actions in the plan. The COM Mayors commitment will play a key enabling role towards the long-term commitment of Cork County Council to transition to a low carbon society and economy.

9.1.4.2 Air Quality Directives, Legislation, and Guidelines

9.1.4.2.1 Air Quality Limit Values

To protect human health, the health of vegetation and ecosystems, the European Union has adopted Directives that specify air quality standards for a wide variety of pollutants. The Directives stipulate how to monitor, assess and manage air quality. In 1996, the European Commission defined the principles to its approach to air quality management with the Air Quality Framework Directive. From the Air Quality Framework Directive, four "Daughter" Directives were produced that include limits for specific pollutants including:

- First Daughter Directive: Sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter and lead
- Second Daughter Directive: Carbon monoxide and benzene
- Third Daughter Directive: Ozone
- Fourth Daughter Directive: Polyaromatic hydrocarbons, arsenic, nickel, cadmium and mercury in ambient air

The *Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC)* was published in May 2008, replacing the Air Quality Framework Directive and the First, Second and Third Daughter Directives. The Fourth Daughter Directive (2004/107/EC) will be included in the CAFE Directive at a later stage.

The CAFE Directive was enacted in Irish legislation by the *Air Quality Standards Regulations 2011* (S.I. No. 180 of 2011). It replaces the *Air Quality Standards Regulations 2002* (S.I. No. 271 of 2002), the *Ozone in Ambient Air Regulations 2004* (S.I. No. 53 of 2004) and the *Ambient Air Quality Assessment and Management Regulations 1999* (S.I. No. 33 of 1999).

The Fourth Daughter Directive was enacted in Irish legislation by the Arsenic, Cadmium, Mercury, Nickel and Polycyclic Aromatic Hydrocarbons in Ambient Air Regulations 2009 (S.I. No. 58 of 2009).

The limit values that have been applied in this assessment are presented in **Table 9.1.**

Table 9.1 Limit values of CAFE Directive 2008/50/EC and *Air Quality Standards Regulations 2011* (S.I. No. 180 of 2011)

Air contaminant	Averaging period	Limit value ($\mu g/m^3$)	Basis of application of limit value
CO	8-hour	10,000	Maximum
NO_2	1-hour	200	Not to be exceeded more than 18 times in a calendar year
	annual	40	Average
PM_{10}	24-hour	50	35th Highest
	annual	40	Average
$PM_{2.5}$	annual	25	Average
SO_2	1-hour	350	Not to be exceeded more than 24 times in a calendar year
	24-hour	125	Not to be exceeded more than 3 times in a calendar year
	annual	20	Average

9.1.4.2.2 Air Quality Assessment and Management Zones

Under Article 4 of the CAFE Directive, EU member states must designate "Zones" for the purpose of air quality assessment and management. Any urban area or agglomeration with a population greater than 250,000 must be defined as a zone. Ireland is divided into four such zones (EPA Online GIS Tool, 2020) (http://gis.epa.ie/EPAMaps/). The designated zones are the Dublin conurbation (Zone A), the Cork conurbation (Zone B), 23 large towns with populations >15,000 including Limerick, Galway, Waterford, Drogheda, Dundalk, Bray, Navan, Ennis, Tralee, Kilkenny, Carlow, Naas, Sligo, Newbridge, Mullingar, Wexford, Letterkenny, Athlone, Celbridge, Clonmel, and Balbriggan, Portlaoise (Zone C) and the remaining area of Ireland (Zone D). The extent of the zones is presented in **Figure 9.2.**

EPA, in partnership with local authorities, manage a series of air quality monitoring stations that are located across Ireland. These stations collect air quality data for public information, which is displayed on EPA's website, and for assessment against the CAFÉ Directive limits and World Health Organisation (WHO) guideline values. There are 50 monitoring sites across Ireland that collect real-time data on air quality.

The closest current air quality monitoring stations to the Belvelly Port Facility is located in a residential area at Cobh Leisure Centre, 3.6 km southeast of Marino Point. PM_{10} is monitored at Cobh Leisure Centre. In 2019, there were no exceedances of the limit value for PM_{10} at this location.

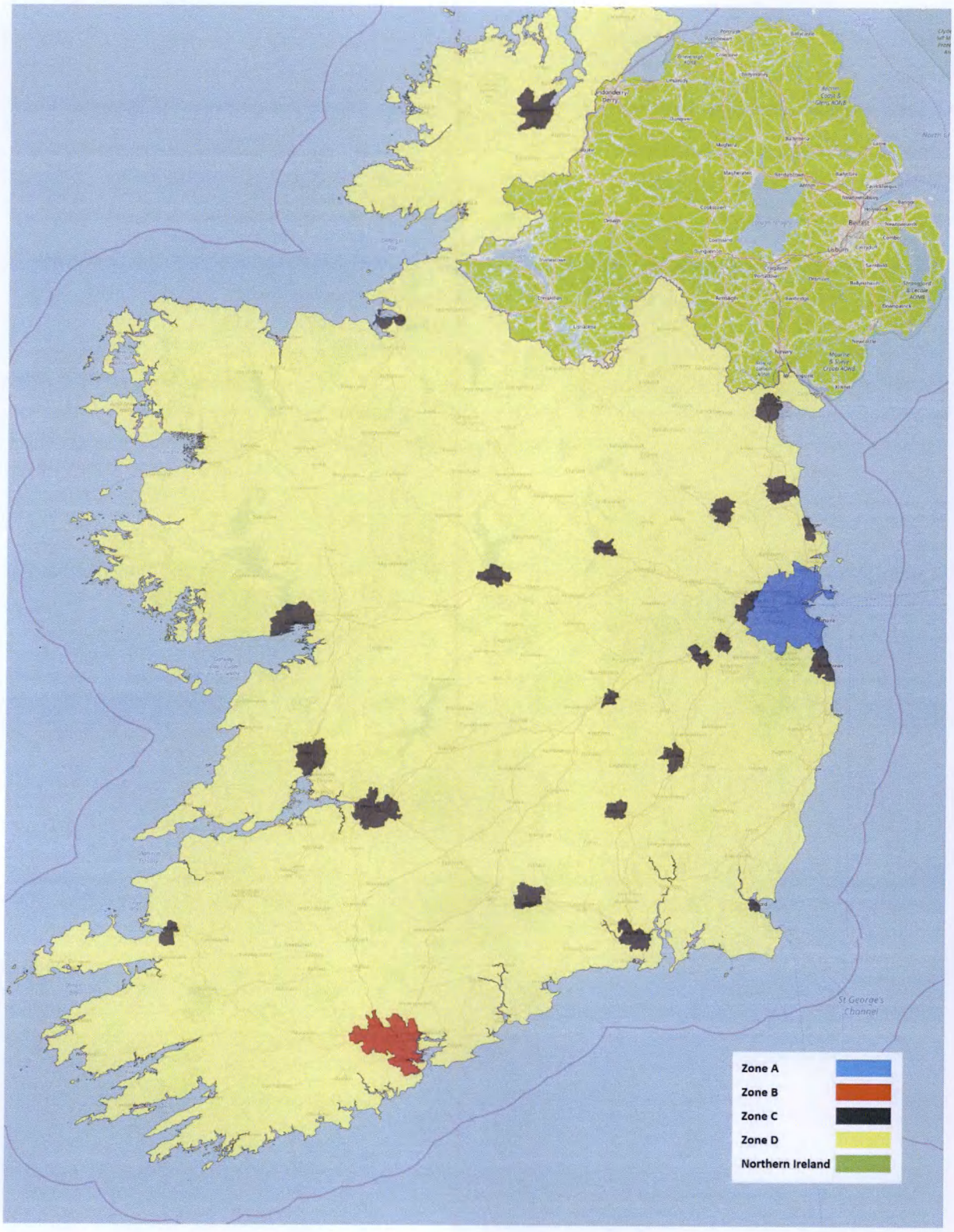

Figure 9.2 Air Quality Zones in Ireland (EPA, 2020)

9.1.4.3 TII Air Quality Guidelines

The potential impacts of traffic emissions on air quality are considered by Transport Infrastructure Ireland (TII) in its guidance document: *Guidelines for the Treatment of Air Quality During the Planning*

and Construction of National Road Schemes (NRA, 2011). The guidance recommends the use of the limit values specified in the CAFE Directive.

9.1.4.4 Dust Deposition Guidelines

Atmospheric deposition is the transfer of atmospheric pollutants such as dust to terrestrial and aquatic ecosystems. Dust particles in the ambient environment can cause nuisance. Localised increases in dust particles are often associated with exposure of soil surfaces, or activities that involve the disturbance of soil or rock-based materials, such as agricultural and construction activities. Whether dust deposition becomes an issue for the general public depends on a variety of factors including the sensitivity of nearby locations, the repetition of any dust deposition occurring and the characteristics of the deposited materials. The focus for dust control and emissions is on minimising the potential for a nuisance occurring in the first instance and implementing good site practices where practicable.

There are currently no Irish or European Union air quality standards for deposited dust. In 2004, the Department of the Environment, Heritage and Local Government (DEHLG) issued *Quarries and Ancillary Activities Guidelines for Planning Authorities states*, which states *"There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert mineral/aggregate dust* (DEHLG, 2006).

A subsequent report issued by the EPA and titled: Environmental Management Guidelines - Environmental Management in the Extractive Industry (EPA, 2006) states:

The impact of dust is usually monitored by measuring rates of dust deposition (DoE, 1995). There are currently no Irish statutory standards or EPA guidelines relating specifically to dust deposition thresholds for inert mineral dust. There are a number of methods to measure dust deposition but only the German TA Luft Air Quality Standards (TA Luft, 1986) specify a method of measuring dust deposition – The Bergerhoff Method (German Standard VDI 2119, 1972) – with dust nuisance. It is the only enforceable method available.

In recent years, the TA Luft air quality standard has become the most commonly used method for the assessment of dust deposition in Ireland. This method involves determining a mass dust deposition rate per unit area over a given time period, using a direct collection pot with standard dimensions of either glass or plastic. The system benefits from being a direct collection method i.e. less transferring of material and consequent reduction in sampling errors. This method is defined as an internationally recognised standard and has been adopted by the EPA as the method of choice for measuring deposited dust associated with licensed facilities.

The TA Luft has recommended a threshold guideline value of 350mg/m^2/day for dust deposition. Below this threshold guideline value dust deposition problems are considered less likely.

The EPA and local authorities commonly apply the TA Luft guideline to development consents and Waste Licences.

9.1.5 Statement of Limitations and Difficulties encountered

There were no difficulties encountered while gathering and processing information for this chapter

9.1.6 Competency of Assessor

This Air Quality and Climate Chapter has been prepared by Micheal Fogarty BE MEngSc PhD of Katestone Environmental Pty Ltd. Micheal has 11 years' consulting experience in air quality assessment, including EIS/EIAR Air Quality and Climate chapters, odour impact assessment, assessment of air quality impact assessment. Full details of Micheal Fogarty's qualifications and experience are provided in **Chapter 1 Introduction**.

9.2 Air Emissions from the Proposed Development

The following proposed activities at the Belvelly Port Facility will result in emissions to the atmosphere:

- Material handling:
  - Loading/unloading dry bulk materials (fertiliser pellets)
  - Transfer to a storage area in an enclosed building
  - Blending of dry bulk materials within the enclosed building
  - Bagging of mixed dry bulk materials within the enclosed building
- Storage of bagged dry bulk materials and products
- Wheel generated dust
- Vehicular and ship emissions.

The dry bulk materials will be delivered to the site's existing jetty on ships. The bulk materials will be unloaded into a hopper using a clamshell grab prior to discharge into trailers. The clamshell grab is partially enclosed to minimise dust emissions. It will also be operated in accordance with the company's cargo handling procedures to further minimise dust emissions. Unloading of the bulk materials will not take place in wet weather. The trailers will be covered and hauled by tractor to the enclosed holding area within the Goulding's facility. The dry bulk materials will be processed as follows to minimise dust:

- Unloaded from trailers within the enclosed area to storage stockpiles that are also within the enclosed area.
- Blended to produce required fertiliser products and bagged in required quantities within the enclosed area
- Bagged final fertiliser products will be loaded onto trucks and transported offsite to customers.

Fuel combustion in the following equipment will produce atmospheric emissions:

- Ships and their associated engines and auxiliary boilers
- Trucks transporting product from the site
- Vehicles transferring raw fertiliser material from the jetty to the Goulding's facility
- Trucks transporting bulk and break cargo from the jetty.

Therefore, dust and fuel combustion will be the primary sources of air pollutants associated with the proposed development.

9.3 Existing Environment

9.3.1 Local weather conditions

The dominant influence on Ireland's climate is the Atlantic Ocean. Consequently, Ireland does not suffer from the extremes of temperature experienced by many other countries at similar latitude. The warm North Atlantic Drift has a marked influence on sea temperatures. This maritime influence is strongest near the Atlantic coasts and decreases with distance inland. The hills and mountains, many of which are near the coasts, provide shelter from strong winds and from the direct oceanic influence. Winters tend to be cool and windy, while summers, when the depression track is further north and depressions less deep, are mostly mild and less windy (Met Eireann https://www.met.ie/climate/climate-of-ireland).

The nearest meteorological station operated by Met Eireann to the Belvelly Port Facility is at Cork Airport, which is approximately 12 km west of the proposed development site at Marino Point. Refer to **Table 9.2** below for data from Cork Airport.

Table 9.2 30-year average meteorological parameters from Cork Airport (1981 to 2010)

Parameter	30-year average
Mean Temperature (°C)	12.9
Mean Relative Humidity (9 AM UTC) (%)	86.7
Mean Daily Sunshine Duration (Hours)	3.9
Annual Rainfall (mm)	1,227.9
Averaged total rainfall (mm) (Summer)	242.0
Averaged total rainfall (mm) (Winter)	384.5
Average Windspeed (m/s)	5.4
Monthly average windspeed (m/s) (Summer)	4.8
Monthly average windspeed (m/s) (Winter)	5.9

Wind speed and wind direction are important parameters for the transport and dispersion of air pollutants from a source. The winter months are wetter and windier than the summer months. A wind rose representing the annual distribution of 1-hour average winds is presented in **Figure 9.3.** The prevailing wind at Cork Airport is from the southwest. Winds from the northeast and southeast are infrequent.

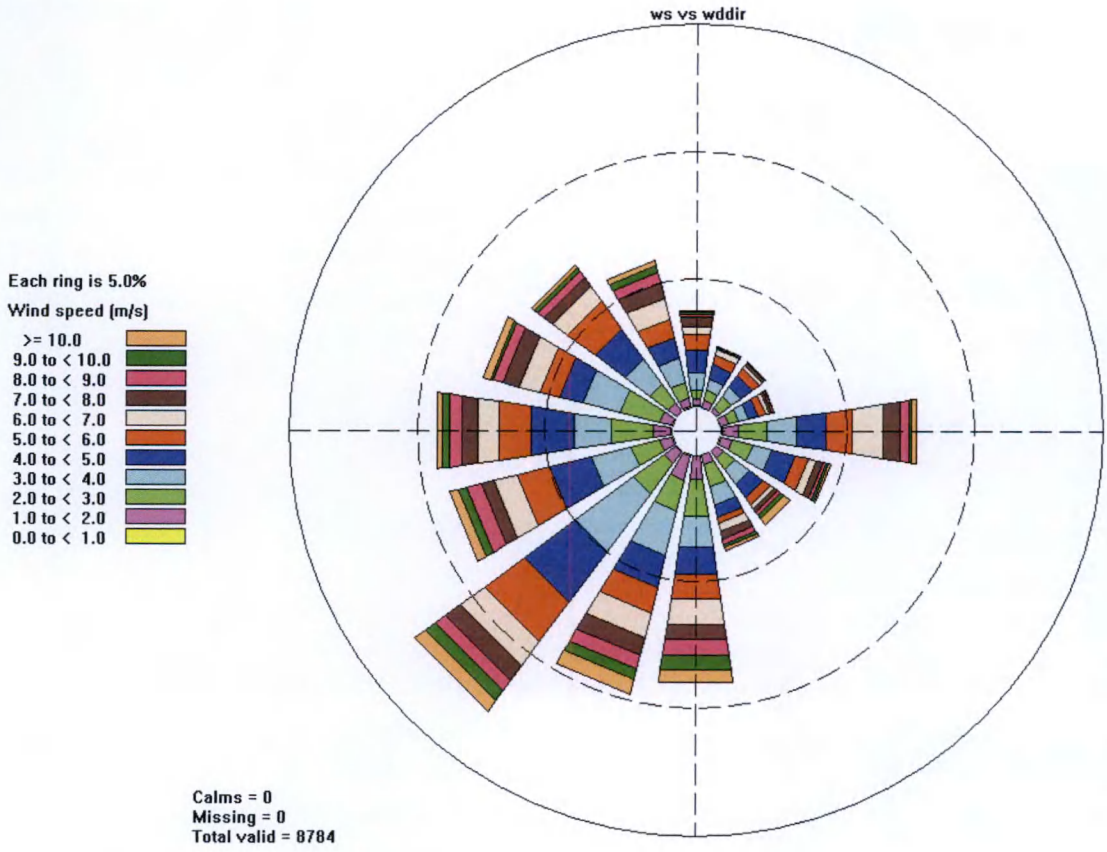

Figure 9.3 Windrose for Cork Airport for 2016 (Source of data: Met Eireann)

9.3.2 Existing Air Quality

There is no site-specific ambient air quality monitoring data for Marino Point. The existing air quality at Marino Point is likely to be good at its location on Great Island is surrounded by a waterway and grassland. Marino Point is bordered to the north, west and south by Lough Mahon and to the east, an area of Great Island, which contains a golf course and agricultural land. This portion of Great Island is sparsely populated.

The sources of emissions that are likely to contribute to background levels of air pollutants at the site include:

- EPA licensed emission points from industry in the harbour area
- Residential sources such as domestic fossil fuel burning
- Transport emissions (road, rail and shipping)
- Agricultural emissions such as dust lift off from ploughing, mowing and tilling.

9.3.2.1 Air Quality Management Area

The Belvelly Port Facility is located in the air quality management area Zone D as defined by the EPA under the CAFE Directive. Air quality management area Zone B is located across Lough Mahon from Marino Point, which includes the urban areas of Passage West and Upper Pembroke and, further afield, Cork. The location of the Marino Point in Zone D and its proximity to Zone B is shown in **Figure**

9.3. Background air quality data for Zone B and Zone D was obtained from the report: *Air Quality in Ireland 2018 – Indicators of Air Quality* (EPA, 2019). A summary of the background data is provided in

- Table 9.3 for Zone B
- Table 9.4 for Zone D

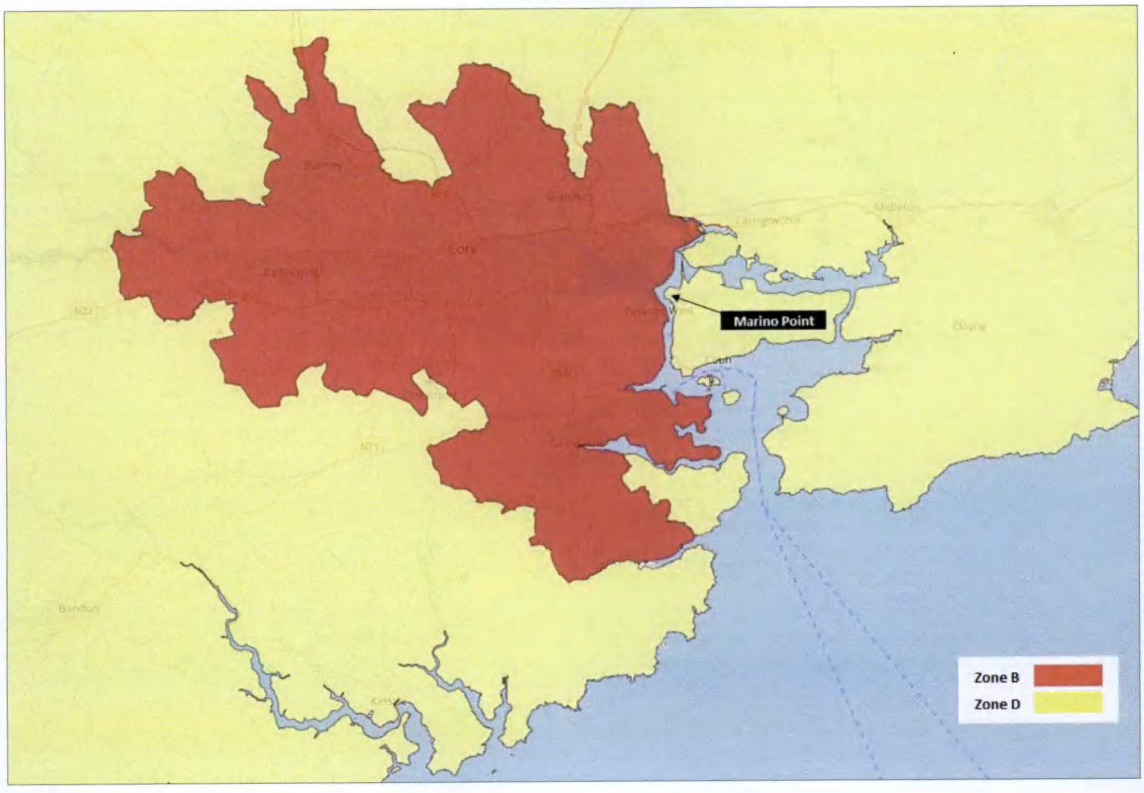

Figure 9.4 Location of the proposed development at Marino Point in relation to EPA air quality management area (Zone B and Zone D) (Source: EPA, 2020)

Levels of air pollutants in Zone B and Zone D are well below the air quality criteria defined in the CAFE Directive and *Air Quality Standards Regulations 2011*. The maximum concentration of PM_{10} measured at the South Link Road in Cork (Zone B) is close to the CAFE Guideline value, however the CAFE allows for 35 exceedances of this value in each annual reporting period. The concentrations of $PM_{2.5}$ and PM_{10} were measured in Cobh, approximately 3.6 km southwest of the Belvelly Port Facility. This monitoring indicates that the level of ambient particulate matter on Great Island is well below acceptable limit values. Refer to **Table 9.3** and **9.4** below.

Table 9.3 Ambient background data from Zone B in 2018

Pollutant	Averaging period	Value[3] (µg/m³)	Limit value[2] (µg/m³)	Source
Nitrogen dioxide	1-hour	132	200	Maximum - South Link Road, Cork
	Annual	25	40	Average - South Link Road, Cork
Sulfur dioxide	1-hour	23	350	Maximum - South Link Road, Cork
	24-hour	12	125	Maximum - South Link Road, Cork
	Annual	2.3	20	Annual - South Link Road, Cork
Carbon monoxide	8-hour	1,300	10,000	Maximum - South Link Road, Cork
PM_{10}	24-hour	48	50	Annual mean - South Link Road, Cork
	Annual	17	40	Average from Cobh
$PM_{2.5}$	Annual	9	25	Median from UCC Distillery Fields

[1] For dispersion modelling purposes the EPA advises that the 36th high 24-hour mean process contribution can be added to the annual mean background PM_{10}

[2] Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)

[3] EPA (2019) (https://www.epa.ie/media/Summary%20data%20tables%202018.pdf)

Table 9.4 Ambient background data from Zone D in 2018

Pollutant	Averaging period	Value[3] (µg/m³)	Limit value[2] (µg/m³)	Source
Nitrogen dioxide	1-hour	92	200	Maximum from Castlebar
	Annual	8.0	40	Average from Castlebar
Sulfur dioxide	1-hour	16	350	Maximum from Kilkitt
	24-hour	6	125	Maximum from Kilkitt
	Annual	2.6	20	Annual from Kilkitt
Carbon monoxide	8-hour	2,800	10,000	Maximum from Portlaoise (Zone C)
PM_{10}	24-hour	26	50	Maximum from Cobh
	Annual	15	40	Average from Cobh
$PM_{2.5}$	Annual	10	25	Median from Cobh

[1] For dispersion modelling purposes the EPA advises that the 36th high 24-hour mean process contribution can be added to the annual mean background PM_{10}

[2] Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011)

[3] EPA (2019) (https://www.epa.ie/media/Summary%20data%20tables%202018.pdf)

9.3.2.2 EPA Licensed Facilities

There are a number of EPA Licensed Facilities with emissions to air located within 5 km of the proposed Belvelly Port Facility. MarinoChem Ltd (EPA License P0034-03) is located on the Marino Point peninsula, bordering the proposed development to the northwest. Other EPA Licensed Facilities are listed in **Table 9.5** and a map illustrating the proximity of these facilities to the proposed development at the Belvelly Port Facility is presented in **Figure 9.5**.

Table 9.5 IED Licenced facilities within 5 km of Marino Point

Facility	EPA License	Distance to Marino Point (km)	Industry
Wexport Ltd	P0091-02	2.9	Pharmaceutical
Corden Pharma Limited	P0134-03	3.1	Pharmaceutical
Janssen Pharmaceutical	P0016-02	3.4	Pharmaceutical
Cara Partners	P0017-02	4.0	Pharmaceutical
Little Island BioEnergy Limited	P1018-01	4.1	Biogas Production
BASF Ireland Limited	P0052-02	4.2	Pharmaceutical/Chemical
Pfizer Ireland Pharmaceuticals	P0013-04	4.2	Pharmaceutical
Merck Millipore Limited	P0571-03	4.5	Biopharmaceutical
Tapella Limited	P0103-02	4.5	Pharmaceutical
Fournier Laboratories Ireland Limited T/A AbbVie	P1046-01	5.0	Biopharmaceutical
Pfizer Ireland Pharmaceuticals	P0013-04	5.0	Pharmaceutical
BioMarin International Ltd	P0864-01	5.0	Pharmaceutical

MarinoChem Limited manufacture formalin solution, urea formaldehyde panelboard resins, melamine urea formaldehyde panelboard resins and urea formaldehyde industrial resins. Onsite energy consumption includes the combustion of natural gas. Annual stack testing for total particulates reported in the annual environmental return (AER) by MarinoChem for 2018 shows measured values that are a small fraction of the licence emission limit values (MarinoChem Limited, 2019).

Considering the closest residential receptors are over 700 m from the main activities that occur at the MarinoChem Limited it is likely that impacts of combustion emissions at these locations are accounted for in the Zone D background concentrations. MarinoChem's 2018 Annual Environmental Report (AER) indicates that it is compliant with all licence conditions for emissions to air.

Apart from MarinoChem Limited, the closest IED licensed facility is Wexport Ltd, which is 2.9 km from the Belvelly Port Facility. The majority of other industries within 5 km manufacture pharmaceuticals. The contribution of emissions from these industries is also likely to be accounted for in the Zone D background concentrations considering:

- Emissions to air from pharmaceutical plants are likely to be associated with onsite generation of energy from natural gas
- The significant distances between these industries and Marino Point.

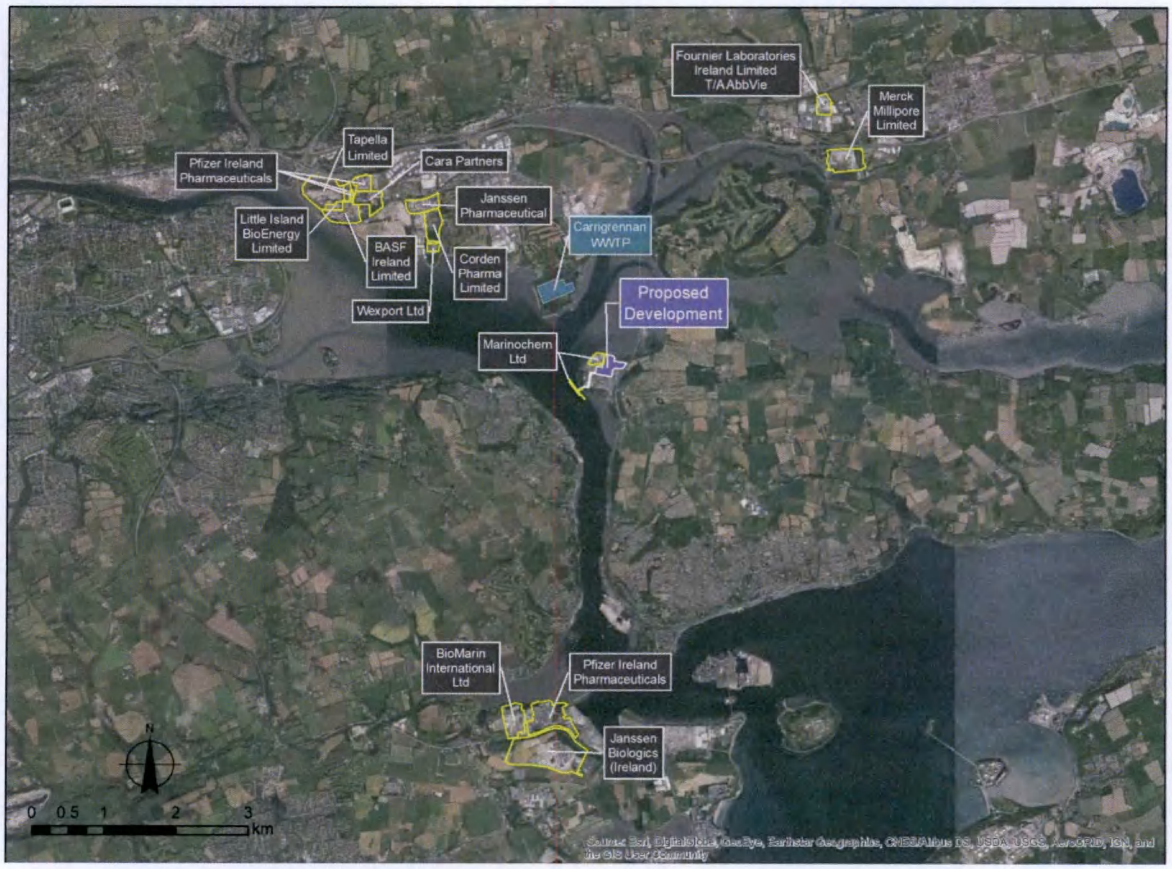

Figure 9.5 EPA Licenced facilities located within 5 km of the Belvelly Port Facility

9.3.2.3 Transport emissions

The R624 regional road and the Cobh to Cork rail line run parallel, east of the Belvelly Port Facility. Concentrations of air pollutants fall quickly with distance from road and rail networks to background levels within 50 metres. Emissions from the R624 and the rail link are likely to be accounted for in the Zone D background concentrations.

An assessment of potential impacts on air quality due to changes in traffic on the R624 is considered in **Section 9.4.2.2**.

9.3.2.4 Urban emissions

The Belvelly Port Facility is located in a semi-rural area. Nearby urban areas and their proximity to the facility are as follows:

- Passage West, located across Lough Mahon, 1 km m from the centre of the Marino Point site
- Cork city, approximately 5 km west of Marino Point
- Cobh, 2.5 km southwest of Marino Point.

Urban activities (home heating and emissions from road traffic) are likely to be the primary source of emissions contributing to ambient levels of PM_{10} and $PM_{2.5}$ in Zone B. Urban activities in the listed areas are likely to contribute to air pollutant levels in the Zone D areas of Great Island. However, given the relative proximity of urban activities to Zone D, air quality measurements are likely to provide a

good indication of background concentrations at sensitive locations in the vicinity of the Belvelly Port Facility on Great Island.

9.3.3 Sensitive Receptors

The proposed Belvelly Port Facility is located in a semi-rural area of Great Island. The area is sparsely populated. The nearest residential receptors to the Belvelly Port Facility are located across Lough Mahon at Passage West and on Great Island.

The nearest sensitive residential receptors to the Belvelly Port Facility are illustrated in **Figure 9.5**. The nearest sensitive receptors are more than 500 m from the blending and bagging operations of the proposed development. Sensitive receptors in Passage West are more than 500 m from shipping and unloading operations of the proposed development and approximately 1 km from blending and bagging operations.

Under the Birds Directive (79/409/EEC) and Habitats Directive (92/43/EEC), Ireland has identified 154 sites as Special Protection Areas (SPA) (NPWS, 2018a) and approximately 13,500 square kilometres of land, lakes and marine environments as Special Areas of Conservation (SAC) (NPWS, 2018b). These are known as Natura 2000 sites and the biodiversity of these sites is required to be protected.

It is well documented that certain forms of atmospheric pollution such as nitrogen and its deposition into the environment are a threat to biodiversity. Ammonia has been found to reduce biodiversity at Natura 2000 sites. There are two Natura 2000 sites in the vicinity of the site, namely:

- Great Island Channel SAC
- Cork Harbour SPA.

The location of these sites is illustrated in **Figure 9.6**.

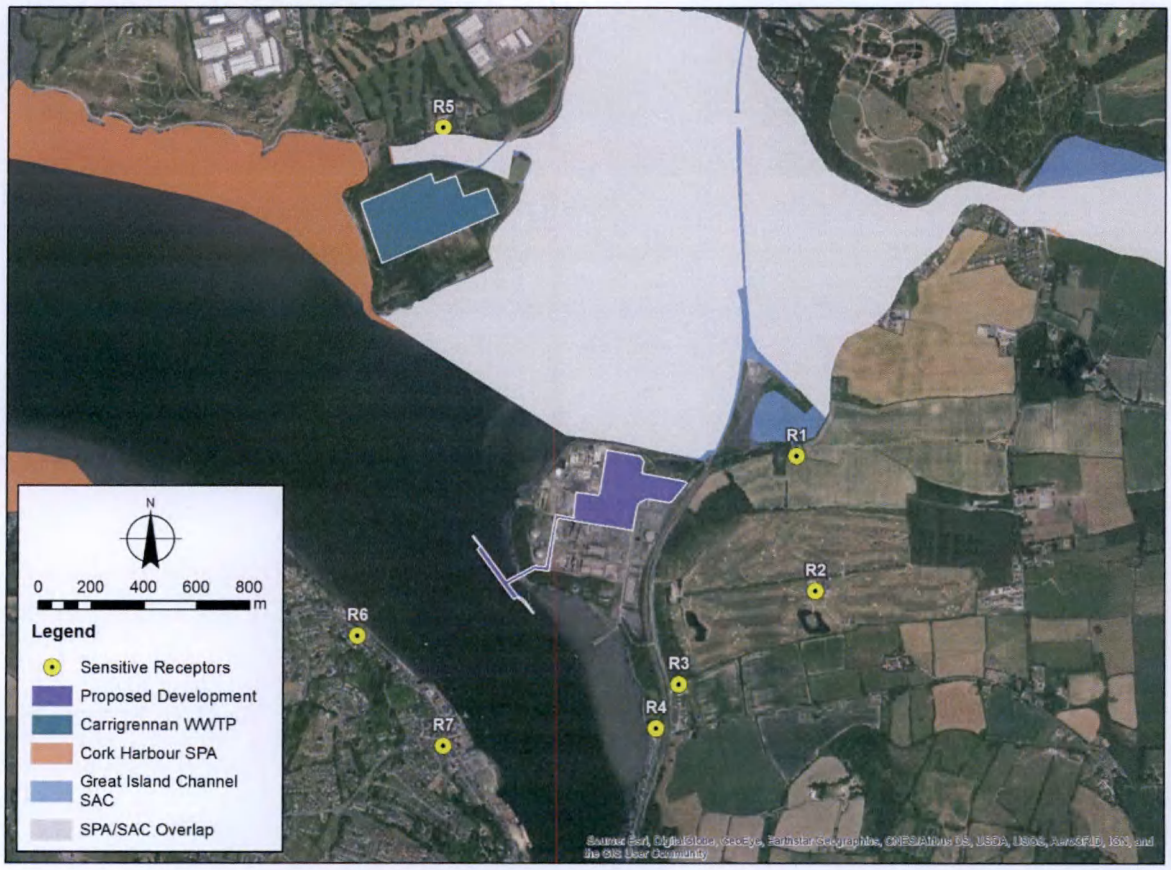

Figure 9.6 Location of the nearest sensitive receptors (residences and Natura 2000 Sites) to the Belvelly Port Facility site

9.4 Likely Significant Impacts

9.4.1 Construction Phase

9.4.1.1 Air Quality

The National Roads Authority's guidance document titled *Treatment of Air Quality During the Planning and Construction of National Road Schemes* (NRA, 2011) deals with the potential impacts of construction activities on local air quality, which states:

The potential impact of both dust and vehicle emissions during the construction phase should be considered within the EIS. Dust emissions can lead to elevated PM_{10} and $PM_{2.5}$ concentrations and may also cause dust soiling.

The predominant emission of concern from the construction phase of the proposed development will be from the generation of dust.

The Department of the Environment, Heritage and Local Government's (DEHLG) guidance document for quarries titled *Quarries and Ancillary Activities Guidelines for Planning Authorities*, states the following in relation to potential impacts:

Residents living in proximity to quarries can potentially be affected by dust up to 0.5km from the source, although continual or severe concerns about dust are most likely to be experienced within about 100m of the dust source.

Construction of the proposed development will have a significantly lower potential to impact sensitive receptors in its vicinity than a quarry for the following reasons:

- The emissions intensity of construction activities will be significantly less than the emissions intensity due to quarrying.
- The nearest residential receptors are more than 500 m from construction activities at the proposed development.
- Construction activities are expected to occur over a relatively short period.
- The proponent will implement a range of management measures that will effectively minimise emissions of dust.

The impact of emissions from the construction phase of the proposed development on nearby Natura 2000 sites has been considered in combination with the potential impact of the construction phase of planning application 19/6783. The boundary of the proposed development is 30 m from the Great Island Channel SAC and the Cork Harbour SPA. The construction phase of the proposed development and the construction phase of planning application 19/6783 will result in dust deposition on the Great Island Channel SAC and the Cork Harbour SPA.

The potential cumulative impact of construction emissions associated with the two projects on the nearby Natura 2000 sites will not be significant because:

- Targeted and more intense controls will be applied to construction areas that are within 100 m of the Natura 2000 sites such as:
    - More frequent monitoring of visible dust
    - Haul road watering
    - Positioning a boundary fence of shade cloth or similar fabric to catch particles of dust.
- Elsewhere on the construction site, dust emissions will be minimised through implementation of the preliminary CEMP.
- Similar dust emission controls are anticipated to be implemented during the construction phase of planning application 19/6783.
- Any residual deposition will occur for a short period of time and will be limited in spatial extent.

9.4.1.2 Greenhouse Gas emissions

Greenhouse gas emissions will occur during construction due the combustion of liquid fuels in heavy machinery and the use of grid electricity. GHG emissions associated with the construction phase are expected to be insignificant in comparison to national GHG emissions. In addition to this, the construction activities are expected to occur in isolation over a relatively short time period and as a result will not have any ongoing impact on Ireland's national GHG inventory.

9.4.2 Operational Phase

9.4.2.1 Air Quality Impacts

The sources of emissions from the operation of the proposed development will be:

- Combustion of diesel fuel in ship engines and boilers
- Combustion of diesel in forklifts, loaders and haulage tractors
- Wheel generated dust from vehicle movements
- Coarse dust from:
- Transfer of bulk fertiliser ingredients from ships to trailers at the jetty
- Transfer of bulk fertiliser ingredients to the enclosed building using tractors and enclosed trailers
- Storage, handling, blending and bagging of bulk fertiliser products in the enclosed storage and processing area.

Bulk fertiliser ingredients will be unloaded into hoppers using a clamshell grab and from the hopper into trailers, which will minimise dust emissions. The trailers used to transfer bulk fertiliser ingredients from the jetty to the processing building will have covers. This will minimise dust emissions from this activity.

Enclosing storage areas, blending areas and bagging areas in a building will minimise emissions of dust from these activities.

Gouldings operates an existing agricultural fertiliser blending and bagging facility at a site that is less than 1 km from Cork city centre and within 40 m of a residential housing estate. There are no reported air quality issues from this facility. The proposed agricultural fertiliser facility will be designed and operated to current best industrial standards.

Emissions of contaminants to air from the proposed Goulding's development are anticipated to be minimal and unlikely to cause adverse impacts at sensitive receptors for the following reasons:

- There will be no major or minor point sources of emissions from the proposed development (as defined by EPA)
- Combustion emissions to air will be limited to:
    - Auxiliary boilers on ships
    - Tractors used to haul bulk materials from the jetty to the blending and bagging area
    - Vehicular emissions (passenger buses and staff cars)
    - Product haulage trucks
    - A domestic boiler
- All fertiliser unloading, blending and bagging will occur in an enclosed building
- All fertiliser will be hauled using covered trailers
- The activity will occur in Zone D that has good baseline air quality. The sources of emissions from the proposed development are not of sufficient magnitude to adversely affect air quality at Zone D receptors

- The air quality indicators from Zone B are well below CAFE Limit Values. The sources of emissions from the proposed development are not of sufficient magnitude to adversely affect air quality at Zone B receptors.
- The closest receptors to the activity are more than 500 m from the Belvelly Port Facility.

The proposed development will generate a relatively small number of ships using the jetty. The following is anticipated:

- One ship carrying fertiliser ingredients will dock per week
- On average four ships carrying bulk and break cargo will dock each month
- The maximum number of ships that will dock at the jetty will therefore be 100 per annum.

In 2018, the Central Statistics Office reported 1,487 ships arrived in the Port of Cork (https://statbank.cso.ie/px/pxeirestat/statire/SelectVarVal/saveselections.asp). In the same year, the annual mean concentration of PM_{10} in the Port of Cork (measured at Cobh), was 15 µg/m³ (compared to a limit value of 40 µg/m³). The daily maximum concentration of PM_{10} was 26 µg/m³ (compared to a limit value of 50 µg/m³). The annual mean concentration of $PM_{2.5}$ was 10 µg/m³ (compared to a limit value of 25 µg/m³). The measured concentrations of particulate matter in 2018 at the Port of Cork are influenced by emissions from shipping, port activities and a range of other sources of emissions including residential heating, road traffic, rail and agricultural emissions.

Consequently, the proposed development will result in a less than 10% increase in the number of ships that currently dock in the Port of Cork. Those ships are, therefore, likely to contribute less than 10% of total shipping emissions in the Port of Cork.

Shipping emissions are a relatively small fraction of overall emissions that contribute to current the current air quality at the Port of Cork. Considering that the level of air contaminants in the vicinity of the proposed development site are currently well below regulatory limits at the current rate of ship arrivals and emission from the operation of the proposed development are limited and well controlled, the risk of exceedances of the regulatory limits due to the increase in shipping is likely to be negligible.

9.4.2.2 Greenhouse Gas emissions

The proposed development is characterised by the relocation of existing facilities from one location to another. Activities conducted at the facility as well as fertiliser production rates are expected to remain relatively unchanged. As a result, the impact of the proposed development on regional and national GHG emissions will be offset by the decommissioning of the existing facility. The net result is that the GHG emissions associated with the proposed development will effectively be neutral and will not have a measurable impact on GHG emissions at either a regional or national scale.

9.4.2.3 Odour Impacts

There are no sources of odour emissions at the proposed agricultural fertiliser facility. The existing agricultural fertiliser blending and bagging facility operated by Gouldings near Cork city centre is within 40 m of a residential housing estate. There have been no odour complaints or odour impacts from this facility. The proposed agricultural fertiliser facility has a significantly greater buffer distance

of 500 m from sensitive residences. Consequently, the proposed development will not result in in odour nuisance at sensitive locations.

9.4.2.4 Cumulative Impacts

It is not anticipated that cumulative impacts will occur at sensitive locations due to the proposed operations at the Belvelly Port Facility as:

- Background air quality monitoring in Zone B shows air quality indicators are well below acceptable limit values
- Background air quality in the Zone D shows air quality indicators are well below acceptable limit values

Additional emissions due to proposed operations will be negligible due to control and abatement of emissions

9.4.3 Traffic Assessment

9.4.3.1 Overview

Road transport associated with a development can account for emissions of several air pollutants, which are also produced by a wide range of industrial, commercial and domestic processes. The pollutants of most concern near roads are nitrogen dioxide (NO_2) and particles (PM_{10}) in relation to human health and oxides of nitrogen (NOx) in relation to vegetation and ecosystems.

The assessment of potential transport related air quality impacts for the proposed development was conducted using the screening method set out in the Design Manual for Roads and Bridges (DMRB) Section 11.3.1, published in May 2007 (DMRB HA207/07).

The overall objective of DMRB is to define the level of assessment necessary to enable informed decision-making at as early a stage of the proposed development as possible. This necessitates a 'fit-for-purpose assessment method and relies on four 'Assessment Levels', namely:

- Scoping
- Simple
- Detailed
- Mitigation/enhancement and monitoring.

For air quality, each assessment level has two components. The first is for local air quality, that is, estimation of pollutant concentrations that could change as a result of the proposed development at specific locations. These concentrations are compared with the air quality criteria set to protect human health or vegetation, as appropriate. The second component is for the regional impact assessment and examines the change in emissions of a range of pollutants as a result of operation of the scheme. The two components may require different assessment levels.

The DMRB air quality scoping assessment methodology has been followed for this assessment, for both local and regional air quality. If the scoping level assessment is triggered, then a simple assessment will be conducted as per the DMRB methodology. The DMRB methodology has been

designed to assess high-level local and regional transport related air quality impacts and requires the following input data:

- Background pollutant concentration data
- Annual Average Daily Traffic (AADT) flows both without the development and with the development
- Average vehicle speed
- Vehicle classification by light and heavy-duty vehicles (LDV/HDV)
- Type of road
- Distance from the centre of the road to the Receptor being assessed.

9.4.3.2 Assessment Criteria

The assessment criteria for the DMRB assessment are defined in HA207/07. It states that a quantitative estimate of the change in local air quality (simple assessment) must be undertaken where the changes on local roads meet any of the following criteria:

- Daily traffic flow will change by 1,000 Annual Average Daily Traffic (AADT) or more
- Heavy duty vehicles (HDV) flows will change by 200 AADT or more
- A change in speed band
- Road alignment will change by 5 m or more.

For the regional air quality assessment, HA207/07 states that a quantitative estimate (simple assessment) of the change in regional air quality must be undertaken where the changes on local roads meet any of the following criteria:

- A change of more than 10% AADT
- A change of more than 10% to the number of HDVs
- A change in the daily average speed of more than 20km/hr.

9.4.3.3 Traffic Data

The traffic data for this assessment was provided to Katestone by Malachy Walsh and Partners. Traffic information on the local road network included consideration of impacts on the R624 road that services the Site. Traffic data was provided for the operational year (2028) for both the "Without development" and "With development" scenarios. Traffic data considered in this assessment is provided in **Table 9.6** and the change with the development in **Table 9.7**.

Table 9.6 Traffic data for the proposed development

Road Link	Link Length	Posted Road	Without Development		With Development	
	(km)	Speed	AADT	% HDVs	AADT	% HDVs
R624 Belvelly Bridge to Marino Point Site	1.98	60	7,252	3.7%	7,379	6.9%
R624 Belvelly Bridge to Fota Island Cross	2.32	60	15,240	2.8%	15,367	3.3%
R624 Fota Island Cross to Cobh Cross	0.72	80	21,898	2.8%	22,025	3.2%

Table 9.7 Change in traffic with the proposed development

Road Link	Change in AADT with Development	Change in %HDVs with Development	Change in road speed
R624 Belvelly Bridge to Marino Point Site	127	32.6%	No change in posted road speed limit.
R624 Belvelly Bridge to Fota Island Cross	127	21.1%	
R624 Fota Island Cross to Cobh Cross	127	14.3%	

9.4.3.4 Local Air Quality - Scoping Assessment

A local air quality scoping assessment has been conducted for the proposed development following the DMRB methodology detailed in the previous sections. The results of the local air quality assessment are detailed in **Table 9.8** and show that based on the anticipated traffic data a simple assessment of local air quality is not required. The proposed development's potential impact on roadside local air quality is negligible.

Table 9.8 Change in traffic with the proposed development

DMRB Criteria	Project Data	Simple Assessment Trigger
Road alignment will change by 5m or more	L3010 widened from 4.8m to 6m	NO
Daily traffic flows will change by 1,000 AADT or more	Max change in traffic flow with development is 322 AADT	NO
Heavy Duty Vehicle (HDV) flows will change by 200 AADT or more	Max change in HDV flow with development is 75 AADT (see Table 13)	NO
A change in speed band	No change to posted road speed limit	NO

9.4.3.5 Regional Air Quality – Scoping Assessment

A regional air quality scoping assessment has been conducted for the proposed development following the DMRB methodology detailed in the previous sections. The results of the regional air quality scoping assessment are detailed in **Table 9.9** and show that, based on the anticipated traffic data, a simple assessment of regional air quality is required due to the change in HDVs on the links of the R624 connecting Marion Point to the Fota Island Cross.

Table 9.9 Scoping level regional air quality assessment

DMRB Criteria	Project Data (see Table 9.6)	Simple Assessment Trigger
A change of more than 10% in AADT	R624 - Site Entrance to Cobh AADT changes by less than 10% with development on all links	NO
A change of more than 10% to the number of HDVs	R624 - Site Entrance to Fota Island Cross HDV % changes on three links by 14.3%, 21.1% and 32.6% with development	YES
A change in the daily average speed of more than 20km/hr	No Change to posted speed limits	NO

9.4.3.6 *Regional air quality – simple assessment*

The assessment of regional air quality considers the potential impact of additional traffic on the links (as defined in the DMRB) between the entrance to the Belvelly Port Facility and the junction of the R624 with the N25. On a regional basis, additional emissions from increased traffic on the N25 are deemed to be roughly equivalent to the emissions from the traffic on the N8 that results from the Goulding's city centre location that will be relocated to the Belvelly Port Facility.

A regional air quality simple assessment has been conducted for the proposed development using the DMRB Screening Method spreadsheet (v1.03c). The screening level assessment uses the traffic information for the proposed development (detailed in **Table 9.7**) coupled with road link length to estimate the change in annual emissions of air pollutants released by vehicles.

The results of the regional air quality assessment are detailed in Table 9.10 and show that based on the anticipated traffic data, annual emissions of CO, THC, NO_x, PM_{10} and carbon increase with the proposed development. This is due to the increase in vehicle movements per year. The largest change in annual emissions is for NOx, which is predicted to increase by 10.4% on the R624 due to increased movements on this road with the proposed development. However, the magnitude of annual emissions regionally is small compared to likely annual emissions from vehicles using the major roads in the region (N8 and M8), located less than 7km away.

Table 9.10 Simple regional assessment results

Scenario	CO	THC	NO_x	PM_{10}	C
	kg/year	kg/year	kg/year	kg/year	tonnes/Year
Without Development	15,246	1,855	6,766	225	1,009
With Development	15,483	1,960	7,470	235	1,065
Change with Development	237	106	704	10	56
	1.6%	5.7%	10.4%	4.3%	5.6%

9.4.3.7 *Greenhouse gas emissions*

Transport requirements of the proposed development compared to existing city centre location are deemed to be roughly equivalent in terms of distance and quantities transported. At a regional level diesel use and associated GHG emissions for the proposed development will be offset by the closure of the existing facility. The net result is that the GHG emissions associated with the transport requirements of the proposed development will not have a material effect on GHG emissions at either a regional or national scale.

9.5 Mitigation

9.5.1 *Construction Phase*

Dust emissions during construction will be managed through the implementation of a Construction and Environmental Management Plan (CEMP). Refer to **(Appendix 2.3)** of Volume 3 for the Outline CEMP. Dust control measures that will be implemented through the CEMP include:

- Cognisance would be taken of the guidelines published by the Institute of Air Quality Management (IAQM), "Assessment of dust from demolition and construction 2014"
- Material handling systems will be designed to minimise exposure to wind
- Stockpiles of materials will be laid out to minimise exposure to wind
- Prolonged storage of materials at the site will be avoided
- A 15kph speed limit will be implemented for all traffic at the site
- Vehicles that transport materials to and from the site will be fitted with covers to prevent material loss
- Public roads outside the site would be regularly inspected for cleanliness and cleaned as necessary using a road sweeper or other effective measures
- Any un-surfaced roads would be restricted to essential construction site traffic only
- While the natural recolonisation of exposed areas of soil during reinstatement activities is preferred, re-seeding would be undertaken where required to promote the rapid stabilisation of soils
- Regular visual inspections will be undertaken around the site to monitor the effectiveness of dust control measures.
- Water misting plant, such as bowsers and sprays will be used as required and where necessary
- Wheel-wash facilities would be provided for vehicles exiting the site to reduce track-out of potential dust materials onto public roads.

9.5.2 Operational Phase

Emissions from the proposed operation of the Belvelly Port Facility will be minimised and managed through the implementation of good proactive cargo handling procedures. Abatement includes standard operating procedures (SOPs) for minimising the likelihood of dust particles becoming airborne, as outlined in the following section.

9.5.2.1 Agricultural Fertiliser Facility

- Material handling crane operation such as:
    - Ensure that grab is operating properly and does not leak fertiliser or dust when full.
    - When grabbing fertiliser, grab shall not be lifted clear of hold until excess fertiliser has fallen or been shaken off.
    - Avoid overfilling grab.
    - Keep grab as low as possible over hopper to minimise drop height before opening.
    - Trailer is parked underneath hopper before being filled.
    - Take care not to spill fertiliser over the edges of the trailer.
    - Do not over fill trailer.
- Harbour mobile crane operation (similar list of requirements to the SOP)
- Hopper operation:
    - Ensure that hopper is positioned as close to ship as possible to minimise crane movement and maximise distance to facility boundary.
    - Fully lower grabs into hopper.
    - Ensure that any screens on hopper are positioned correctly.
    - Check condition of curtains on hopper for integrity.

- Position trucks centrally under hopper.
- Communicate with driver to move truck forward as required.
- Avoid fully emptying hopper.
- Trucks shall not be overfilled. Avoid spillages.

- Truck operation
  - Tailgate to be securely closed after tipping at the store and BEFORE leaving the store and returning to the weighbridge/hopper. No trailer with defective or leaking tailboard is to be employed.
  - Trucks to be driven at moderate speeds.
  - Any truck which is departing the facility is to be covered immediately.

- Housekeeping to minimise emissions:
  - All spills to be cleaned up immediately and removed.
  - Road sweeper to be used if fertiliser spillage and dust are noted on roads and open areas.
  - Clean hoppers after use

Abatement also includes standard operating procedures (SOPs) for dust abatement including

- The use of water sprays to control dust emissions downwind of operations while grabbing/discharge is underway:
- Operate road sweeper at more regular intervals.

Operational site management including the use of weather forecasts to plan operations to minimise emissions.

All bulk materials that have been unloaded from ships will be transferred to an enclosed building for storage, stockpiling, blending and bagging. Enclosing these activities within a building will significantly reduce emissions of dust to the atmosphere from these activities. This has been demonstrated as an effective method for controlling emissions of dust at the existing agricultural fertiliser blending and bagging facility near Cork City where adverse dust deposition impacts are not reported by a community that lives in much closer proximity operations compared to the proposed development site.

9.5.2.2 Additional Port Use of the Jetty

SOPs relating to the additional use of the jetty will follow similar procedures as outlined above, where relevant in order to minimise emissions during loading and unloading of cargo at the jetty. The cargo types proposed will include woodchip, machinery parts, deep sea maintenance and exploratory vessel engineering cargo, and other miscellaneous dry cargo.

9.6 Climate vulnerability

In addition to the potential impact of the proposed development on climate change as a result of GHG emissions, the potential vulnerability of the proposed development to the impacts of climate change is considered in this section. The projected changes in climate variables of relevance to the proposed

development based on 'Integrating Climate Change into Strategic Environmental Assessment in Ireland – A Guidance Note' (EPA, 2015) are summarised in

Table 9.11. The potential impacts of climate change on the project are:

- Damage to infrastructure as a result of sea level rise.
- Increased site run off due to heavy rainfall and storm surge.

Table 9.11 Changes to climate variables relevant to the proposed development due to climate change (EPA, 2015)

Climate variable	Projected change
Sea level rise	A rise of 60 cm is projected by 2100 with medium confidence. Changes in sea level will magnify the impacts of storm surges and wave patterns in coastal areas.
Coastal flooding	Increased risk of coastal flooding due to storm surge
Extreme events	Increase in the frequency of heavy rainfall particularly in winter

9.7 Residual Impacts

The risk of adverse impacts to air quality from operations at the proposed development is negligible considering:

- The good quality of baseline air quality at sensitive locations near the proposed development
- The limited effect of the proposed development on traffic emissions.
- The limited number of ships (and hence shipping emissions) docking at jetty associated with the proposed development.
- The lack of odour emissions from the proposed development.
- The high level of dust control achieved by:
    - Covering trailers transporting bulk materials
    - Enclosing dust generating activities.
- Diligent application and adherence to the CEMP during construction of the proposed development.
- Diligent application and adherence to the Goulding Fertilisers proposed cargo handling procedures at Belvelly Port Facility during operations.

9.8 References

DEHLG (2004) Quarries and Ancillary Activities Guidelines for Planning Authorities. https://www.housing.gov.ie/sites/default/files/migrated-files/en/Publications/DevelopmentandHousing/Planning/FileDownLoad%2C1606%2Cen.pdf

EPA (2006) Environmental Management Guidelines Environmental Management in the Extractive Industry (Non-Scheduled Minerals). https://www.epa.ie/pubs/advice/general/EPA_management_extractive_industry.pdf

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IAQM (2014) Guidance on the assessment of dust from demolition and construction. http://iaqm.co.uk/wp-content/uploads/guidance/iaqm_guidance_report_draft1.4.pdf

National Roads Authority (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes.

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10. ARCHAEOLOGY, CULTURAL HERITAGE AND ARCHITECTURAL HERITAGE

10.1 Introduction

This chapter comprises an assessment of the likely effects the proposed development, as detailed in **Chapter 2 Description of the Proposed Development,** will have on the archaeological, architectural and cultural heritage environment. The chapter describes the impact assessment methodology, summary of the proposed development, receiving environment, likely significant impacts, and recommended mitigation measures.

Some terms used in this chapter are explained hereunder.

10.1.1 Archaeological Heritage

Archaeological heritage can be described as the study of past human societies through their material remains and artefactual assemblages. The Valetta Treaty (or the European Convention on the Protection of the Archaeological Heritage, 1992) defines archaeological heritage as "all remains and objects and any other traces of humankind from past times" this includes "structures, constructions, groups of buildings, developed sites, moveable objects, monuments of other kinds as well as their context, whether situated on land or under water". In order to obtain a comprehensive appraisal of the archaeological heritage of the site, much of which is no longer visible above ground, a study area comprising circa 1.5km radius of the proposed development site was examined. Significant archaeological sites which are located outside the immediate study area but reflect human activity within the broader landscape are mentioned, where relevant.

10.1.2 Architectural Heritage

Architectural heritage is defined in the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999 as structures and buildings together with their settings and attendant grounds, fixtures and fittings, groups of such structures and buildings, and sites, which are of architectural, historic, archaeological, artistic, cultural, scientific, social or technical interest.

The assessment includes an appraisal of all buildings of architectural, historical and social interest within or adjacent to the proposed development site. It provides a history, record and description of structures of architectural significance and an evaluation of their characteristics and importance to the area around the Marino Point development site.

10.1.3 Cultural Heritage

Cultural Heritage is an expression of the ways of living developed by a community and passed on from generation to generation. This includes customs, practices, places, objects, artistic expressions and values. Cultural Heritage is often expressed as either Tangible or Intangible Cultural Heritage (ICOMOS, 2002). Environmental Protection Agency (EPA) Guidelines (2015) define Tangible Cultural Heritage as

movable cultural heritage (artefacts), immovable cultural heritage (monuments, archaeological sites and so on) and underwater cultural heritage (shipwrecks, underwater ruins and cities). Intangible cultural heritage encompasses oral traditions, folklore, history and language. Cultural Heritage in this report includes archaeological heritage, architecture, history, landscape and garden design, folklore, and tradition, geological features, language and dialect, religion, settlements, inland waterways (rivers) and place names. There are no specific cultural heritage sites within the proposed development. As such an account is given of the history and cultural heritage of the local area.

10.1.4 Scope of Assessment

The proposed development site lies within the Belvelly Port Facility at the northern end of the Marino peninsula. Goulding Chemicals Limited, hereafter referred to as Goulding, is proposing to construct a new agricultural fertiliser facility on the site. The primary use of the new facility will be blending and bagging of dry bulk materials for storage and distribution. The proposed development will include the following elements:

- a storage warehouse;
- a bagging and palletising facility;
- an office building to support customer service and weighbridge operations;
- external storage bays with associated circulation space, weigh-bridges, access control and security facilities; and
- importation of raw materials at the existing jetty.

The proposed development also includes additional BMDC port operational use of the jetty to facilitate general dry cargo vessels at the Belvelly Port Facility.

Full details of the proposed development are provided in **Chapter 2 Description of the Proposed Development.**

The northern end of the Marino peninsula is a brownfield site that was reclaimed during construction of the former Irish Fertiliser Industries (IFI) in the 1970's. It is possible that hitherto unknown archaeological finds or features may be present in this area in the original mud flats that lie beneath the reclaimed overburden which has been established by Geotechnical Investigations as being up to 2.5m deep.

As detailed in **Chapter 2 Description of the Proposed Development**, construction methods on the site will include piling using CFA piles and excavation for underground utilities. Some of these excavations will exceed 2.5m in depth and will therefore impact on the underlying muds within the development area.

10.1.5 Methodology

The methodology for the archaeological, architectural, and cultural heritage section of the EIAR consists of the following steps:

- A review of the relevant legislation and guidelines;
- A desktop study of the proposed development site and Study Area;
- A walkover survey of the proposed development site;
- An evaluation of the likely impacts of the proposed development on the archaeological, architectural and cultural heritage of the proposed development site; and
- Proposed mitigation measures to be undertaken to prevent or reduce any potential impacts on the archaeological, architectural and cultural heritage.

10.1.6 Legislation and Guidelines

In Ireland, the principal legislative measures protecting cultural heritage assets are the National Monument (Amendments) Acts 1930 to 2014, the Heritage Act 1995, the relevant provisions of the National Cultural Institutions Act 1997, the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 and the Planning and Development Act 2000. Moreover, policies for both the archaeological and architectural heritage are relayed in a series of specific published guidelines.

This chapter is prepared having regard to the following guidelines:

- Guidelines on the information to be contained in Environmental Impact Statements, (Environmental Protection Agency, 2002) and Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (2017);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements, (Environmental Protection Agency, 2003) and Draft Revised Advice Notes (2015);
- Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment (Department of Housing, Planning and Local Government, 2018);
- Framework & Principles for the Protection of the Archaeological Heritage, (Department of Arts, Heritage, Gaeltacht & the Islands, 1999);
- *Policy & Guidelines on Archaeological Excavation,* (Department of Arts, Heritage, Gaeltacht & the Islands, 1999); and
- Architectural Heritage Protection, Guidelines for Planning Authorities, (Department of the Environment, Heritage and Local Government, 2004).

Comprehensive guidelines on the treatment of the archaeological and architectural heritage during the planning and design of national road schemes were published by the National Roads Authority (now Transport Infrastructure Ireland) in 2005. These were also used as a guide in the compilation of this EIAR.

- Guidelines for the assessment of Archaeological Heritage Impacts of National Road Schemes, (NRA, 2005a); and
- Guidelines for the assessment of Architectural Heritage Impacts of National Road Schemes, (NRA, 2005b).

10.1.7 Assessment Criteria

Impacts of the proposed works on the archaeological, architectural and cultural heritage are assessed in accordance with *Guidelines on the Information to be contained in Environmental Impact Assessment Reports* (EPA Draft 2017). An evaluation of the likely significant impacts of the proposed development is given with reference to the EPA Description of Effects (2017, 50). The effects are described as positive, neutral or negative under the following headings:

- Imperceptible – An effect capable of measurement but without significant consequences;
- Not Significant – An effect which causes noticeable changes in the character of the environment but without significant consequences;
- Slight Effects – An effect which causes noticeable changes in the character of the environment without affecting its sensitivities;
- Moderate Effects – An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends;
- Significant Effects – An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment;
- Very Significant – An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment; and
- Profound Effects – An effect which obliterates sensitive characteristics.

10.1.8 Desktop Study

The desktop study provided an overview of the archaeological, architectural, and cultural heritage features of the proposed development site and study area using the following sources:

10.1.8.1 Record of Monuments and Places (RMP)

This record was established under Section 12 (1) of the National Monuments (Amendment) Act 1994. It lists all monuments and places believed to be of archaeological importance in the County. The numbering system consists of two parts: the first part is the county code (CO for Cork) followed by the Ordnance Survey map number (six inch to the mile scale); the second part is the number of a circle surrounding the site on the RMP map, e.g. (CO75-013) refers to circle 013 on OS sheet 075 for County Cork. The area within the circle is referred to as the *Zone of Archaeological Potential (ZAP)* or zone of notification for that site. Its diameter can vary depending on the size and shape of the site but it averages out at approximately 180m. The RMP for County Cork was published in 1998.

10.1.8.2 Sites and Monuments Record (SMR) Database of the Archaeological Survey of Ireland

The purpose of the Archaeological Survey of Ireland (ASI) is to compile a base-line inventory or Sites and Monuments Record (SMR) of the known archaeological monuments in the State. It contains details of all monuments and places or sites known to the ASI which pre-date AD 1700, and a selection of monuments which post-date 1700. The large record archive and databases resulting from the survey are continually updated. Archaeological sites which are added to the database are proposed to

be included in the next published edition of the RMP and will then be afforded its protection. This database, complete with maps, is available for consultation via the National monuments Service (NMS) website[1].

10.1.8.3 Archaeological Inventory

The inventories for each county are follow-ons by the Archaeological Survey of Ireland, to the RMPs. They give a written description of each archaeological site in the county. The archaeological inventory for East and South Cork, Volume 2 (Power, Byrne, Egan, Lane & Sleeman, 1994), was published in 1994 and a follow up volume, Volume 5 (Ronan, Egan & Byrne, 2009), was published in 2009.

10.1.8.4 Consultations

During the compilation of the EIAR the following were consulted:

County Archaeologist, Cork County Council

Consultation was held with Mary Sleeman Cork County Archaeologist. Her recommendation is for intermittent monitoring of excavation works during construction and this is incorporated in the mitigation measures in **Section 10.4** below.

National Monuments Service

Consultation was held with The National Monuments Service (NMS). The response is provided in **Appendix 1.3.**

10.1.8.5 Archive Unit Files - NMS

There is no information on some of the RMP sites within the Study Area on the ASI database or in the Inventory. The Archive Unit of the NMS, located in Custom House, Dublin contains an extensive body of hard copy material relating to the archaeological heritage of the State. The main collections consist of the RMP files comprising reports on archaeological sites. The Archive Unit Files were consulted for information on RMP sites within the Study Area.

10.1.8.6 Files of the NMS, DAU

These files were consulted in order to retrieve information on lists of RMP sites that have been afforded added protection such as;

- National Monuments in the ownership or guardianship of the state – None in the Study Area
- National Monuments in the ownership or guardianship of the local authority – None in the Study Area
- Monuments subject to Preservation Orders and Temporary Preservation Orders – None in the Study Area
- Monuments listed in the Register of Historic Monuments –None in the Study Area

[1] www.archaeology.ie

10.1.8.7 Files of the National Museum of Ireland (NMI)

The topographic files of the NMI were searched for the townlands in the study area. Finds recorded from townlands within the study area are referred to in the Existing Environment **Section 10.2** and in **Appendix 10.1.**

10.1.8.8 Cork County Development Plan (2014-2020)

The Cork County Development Plan (CDP) outlines Cork County Council's objectives with regard to the preservation of the archaeological, architectural and cultural heritage of the County. The plan also outlines the Council's objectives regarding the protection of the archaeological heritage, including the protection of monuments listed in the SMR and RMP, by preservation *in situ*, or in exceptional cases, preservation by record. It also aims to safeguard 'sites and settings, features and objects of archaeological interest generally'. The zones of archaeological potential identified in the RMP are to be protected, as are underwater archaeology and historic towns. The CDP states that the significance of medieval archaeology, industrial and post medieval archaeology, battlefield and siege sites, as well as structures shown on the 1st and 2nd edition Ordnance Survey 6-inch maps are to be assessed prior to any development. The Plan also states that the maintenance of burial grounds will be encouraged through appropriate maintenance and conservation, and that where development may have an impact on the archaeological heritage, an archaeological assessment will be required, and appropriate mitigation measures shall be put in place.

The CDP states that preservation *in situ* is the preferred option and that there must be compelling reasons to justify preservation by record. Development that does not compromise sub-surface archaeological remains will be encouraged, and development that does not have a visual or physical impact on the setting of a monument will be favoured. According to the CDP, previously unidentified archaeological sites that are uncovered during construction works must be investigated and recorded.

The rich and varied architectural heritage of the County is protected through the inclusion of buildings in the Record of Protected Structures (RPS), as required in the Planning and Development Act 2000 (Part IV). This record includes all structures or parts of structures which are, in the opinion of the Council, of 'special, architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest'. This designation is to ensure that changes or alterations to the included buildings or their settings will be carried out in such a way that their existing special character and setting is retained and enhanced.

One of the CDP's objectives is to preserve the character of a place, area, group of structures, or townscape in order to preserve the character of that area. Any "place, area, group of structures or townscape that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or contributes to the appreciation of protected structures" is an Architectural Conservation Area (ACA). ACAs will be conserved and their special character enhanced, including their "traditional building stock and material finishes, spaces, streetscape, shop fronts, landscape and setting". There are no ACA's within the study area.

The CDP outlines how the rich and diverse cultural heritage of the County will be promoted and protected by Cork County Council "as an important economic asset". The Plan includes "*language, the arts, creative industries, enjoyment of the natural, historic and built environment, events and festivals, use of tourist attractions, libraries, museums, archives and galleries, industrial heritage, the diversity of the faith communities and places of worship, local cultural traditions and sport and recreation*" as culture that helps to define the perception of the County and provides a sense of identity. The Plan acknowledges the importance of folklore, oral cultural heritage, and historic heritage sites, including battle sites, historic rights of way, and Irish place names.

10.1.8.9 National Inventory of Architectural Heritage (NIAH)

The NIAH was set up under the Convention for the Protection of the Architectural Heritage of Europe or the Granada Convention of 1985. It was established on a statutory basis under Section 2 of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999. The work of the NIAH involves identifying and recording the architectural heritage of Ireland, from 1700 to the present day, in a systematic and consistent manner. It is divided into two parts; The Building Survey and Historic Garden Survey (www.buildingsofireland.ie). The main function of both is to identify and evaluate the State's architectural heritage in a uniform and consistent manner, so as to aid its protection and conservation. The NIAH carried out a survey of the buildings of County Cork between 2006 and 2011. Under Section 53 of the Planning and Development Act 2000, all structures considered of regional, national or international Importance within the survey are recommended for inclusion in the RPS by the Minister for Arts Heritage and the Gaeltacht. If this is not adopted by the local authority, the reasons must be communicated to the Department. The Building and Historic Garden Survey for County Cork is available online.

The NIAH for County Cork includes approximately 6,500 items of architectural importance in the County. The structures identified as being of international and national importance are included in the new RPS. Other structures of regional importance were considered for inclusion in the record. Cork County Council recognises the important contribution that all historic structures, including those not on the record, make to County Cork's heritage. The Council will seek the enhancement of these elements in recognition of their "quality, character and local distinctiveness" (Cork County Development Plan 2014, Vol 1, p.194) and will "give regard to and consideration of all structures which are included in the NIAH for County Cork, which are not currently included in the Record of Protected Structures, in development management functions" (*ibid.* 195). In addition to these objectives, the Council will seek to enhance all historic structures, features and landscapes not included in the RPS as well as non-structural elements such as designed gardens, garden features, masonry walls, railings, follies, gates, bridges and street furniture.

10.1.8.10 Database of Irish Excavation Reports (www.excavations.ie)

This website provides a database of summary accounts of archaeological excavations and investigations in Ireland undertaken between 1970 and 2018. Until 2010, these accounts were also published in book form. The database was queried for any investigations undertaken in any of the

townlands within the Study Area. Details of these excavations are given in the **Existing Environment Section 10.2** and in **Appendix 10.1.**

10.1.8.11 Site-specific publications

The local history section of Cork County Library was consulted to obtain information on the Study Area. This would have included historical journals, local history publications etc., all of which are listed in the bibliography.

10.1.8.12 Aerial photographs

Ordnance Survey of Ireland online aerial photographs (dated 1995, 2000 and 2005-2012)[2] and Google maps online aerial photographs[3] are available for viewing. These were examined to identify any previously unrecorded features of archaeological/cultural heritage significance that may only be visible from the air. No archaeological features were apparent on the photographs.

10.1.9 Statement on Limitations and Difficulties Encountered

Many archaeological sites survive today as upstanding structures such as Marino House (CO075-013) and orangery (CO075-076), located *c.* 250m outside the proposed development site to the south. Many more archaeological sites, however, survive only as levelled subsurface features, where they often remain undisturbed and unknown until they are revealed by ground disturbance or archaeological investigation in advance of development.

The proposed development site lies within the Belvelly Port Facility site at the northern end of the Marino peninsula which was reclaimed from Cork Harbour in the 1970's. The proposed development site is brownfield comprising upstanding buildings at the southwest, internal roads and car parking areas associated with the former IFI complex. While no upstanding archaeological sites are visible within this brownfield site, it is possible that archaeological finds or features may survive intact beneath the reclamation fill. Geotechnical Investigations undertaken in this area confirm that the reclamation material is at a depth of 2.5m.

10.1.10 Competency Of Assessor

The assessment was carried out by Lane Purcell Archaeology. Lane Purcell Archaeology is an archaeological consultancy comprising a small team of highly qualified, professional archaeologists experienced in all aspects of archaeological consultancy and project management. The qualifications and experience of the archaeologists that prepared this chapter are described in **Chapter 1 Introduction**.

[2] www.osi.ie

[3] www.google.ie/maps

10.2 EXISTING ENVIRONMENT

10.2.1 Site Location and Description

The proposed development site (approximately 7.6 hectares in extent) lies within the Belvelly Port Facility at the northern end of the Marino Point peninsula, *c.* 5km to the northwest of the town of Cobh. Marino Point is an area of land situated on the north western side of Great Island which is bordered by Cork Harbour to the north, south and west and by the Cork to Cobh Railway line and the R624 Cork to Cobh regional road to the east. The village of Passage West lies to the west, *c.* 1km from the centre of Marino peninsula on the opposite side of the harbour.

The proposed development site is bordered to the north by reclaimed ground and a manmade lagoon, to the south by a brownfield area comprising an industrialised landscape of upstanding former IFI superstructures, to the east by an internal roadway and ESB substation and to the west by the operational Marinochem Plant.

The northern end of the peninsula, where the development site is situated, was reclaimed post 1938, probably in the 1970's during the construction of the IFI plant. The original shoreline of Marino Point peninsula is now a brownfield area. However, it is possible that undisturbed muds exist beneath this reclaimed overburden with the potential to yield archaeological finds or features. Marino House (CO075-013) and orangery (CO075-076) lie on the southern extremity of Marino Point peninsula, *c.* 250m outside the proposed development site.

10.2.2 Archaeology and Cultural Heritage

The proposed development site is situated in the townland of Marino in Cork's upper harbour in the parish of Clonmel and the Barony of Barrymore. There are no recorded archaeological sites listed in the RMP for Co. Cork or on the SMR database of the ASI within the proposed development site (**Figure 10.1**). The RMP lists all archaeological monuments and places known to be of archaeological importance in the county and affords them statutory protection under the National Monuments Act 1930 to 2004 (1994 amendment). The closest RMP sites to the proposed development site are Marino House (CO075-013) and Orangery (CO075-076), *c.* 250m and designed landscape feature (CO075-027), *c.* 180m to the south. The designed landscape feature, a possible tennis court/garden feature dating from the mid-20th century, was removed in the 1970's during the construction of the IFI complex.

Figure 10.1 Proposed development site outlined in red within the Belvelly Port Facility outlined in blue on OS map with RMP and NIAH detail4

In total, there are twenty eight recorded archaeological sites within a 2km radius of the proposed development site (**Table 10.1** and **Figure 10.2**). These monuments provide evidence for human settlement and activity within the study area dating back to the Bronze Age. Since this time, human populations have organised and altered the landscape for a diversity of purposes, be it agricultural, social, political, or religious.

[4] www.archaeology.ie

Table 10.1 RMP sites within 2km of the proposed development site

RMP & NIAH	SITE TYPE	TOWNLAND	DISTANCE
CO075-013 & 20907585	Country House	Marino	250m to south
CO075-027	Designed landscape feature	Marino	180m to south
CO075-074	Building	Marino	210m to SE
CO075-076 & 20907585	Orangery	Marino	250m to south
CO075-024001	Midden	Carrigrenan	1.4km to NW
CO075-024002	Designed landscape feature	Carrigrenan	1.4km to NW
CO075-046	Folly	Foaty	1.7km to N
CO075-026, 20907592 & PS 01366	Monning Martello tower	Belvelly	850m to north
CO075-028	Designed landscape feature (tree ring)	Belvelly	600m to E
CO075-029	Martello tower	Belvelly	1.5km to NE
CO075-030	Tower House	Belvelly	1.6km to NE
CO075-031	Brickworks	Belvelly	1.5km to NE
CO075-033	Ringfort	Lissanisky	1.4km to SE
CO075-034	Ringfort	Lissanisky	1.6km to SE
CO075-035	Fulacht fia	Lissanisky	1.8km to SE
CO075-036001	Fulacht fia	Lissanisky	1.7km to SE
CO075-036002	Fulacht fia	Lissanisky	1.7km to SE
CO075-037	Ringfort	Lissanisky	1.7km to SE
CO075-042	Ringfort	Lissanisky	1.6km to SE
CO075-079	Country House	Ardmore	1.8km to W
CO075-089	Pit	Foaty	2km to NE
CO075-090	Pit	Foaty	1.8km to NE
CO075-091	Fulacht fia	Foaty	1.8km to NE
CO075-092	Fulacht fia	Foaty	1.8km to NE
CO075-093	Excavation miscellaneous	Foaty	2km to NE
CO087-007	Holy well	Ballyleary	1.4km to SE
CO087-110	Beeboles	Ballynoe	2.1km to S
CO087-125	Fulacht fia	Ballynoe	2.1km to S

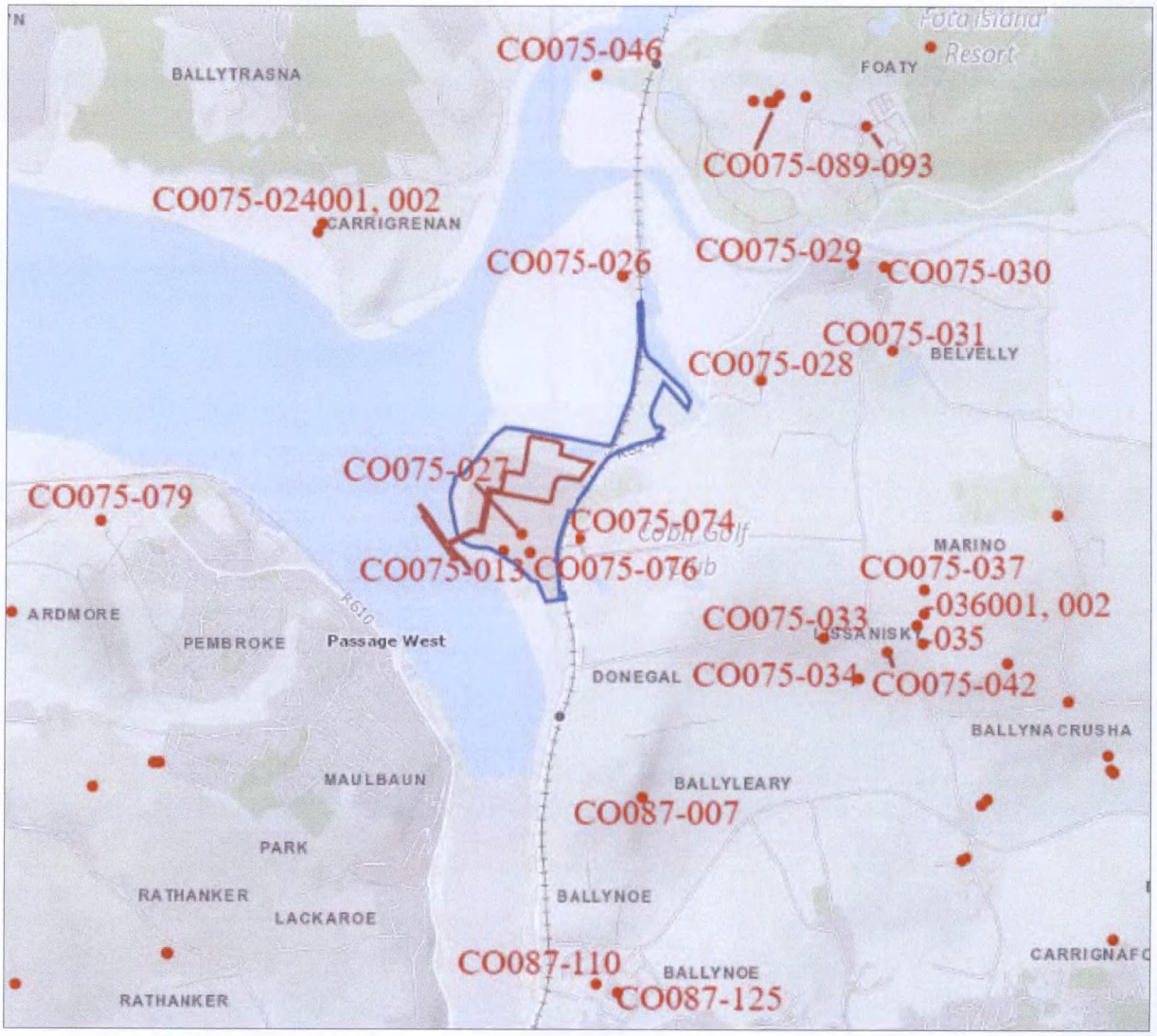

Figure 10.2 Proposed development site outlined in red within the Belvelly Port Facility, as outlined in blue on OS RMP map showing recorded archaeological sites within a 2km radius of the development site

The pace of landscape change in Ireland accelerated in the second half of the 20th century and many archaeological sites have been levelled by activities associated with modern development and progress such as agriculture, industry and infrastructural improvements. This has ensured that the present day archaeological landscape is not fully representative of the human occupation of this island, which has spanned some nine thousand years. While many archaeological sites survive today as partially upstanding structures, such as earthworks and stone monuments, many more survive only as subsurface remains, often forgotten and concealed from view. Subsurface archaeological remains are usually uncovered during archaeological investigations in advance of development. Much of the physical evidence for the existence of past societies has been altered by each successive community, all of which leave their mark on the landscape they have occupied. A full chronological account of the

archaeological and cultural heritage of the Study Area is presented in **Appendix 10.1**. The following is a summary of that account focussing on the more relevant pertinent points.

The archaeological timescale can be divided into two major periods, each with a number of sub-sections:

1. **The prehistoric period:** Mesolithic - (*circa* 8000 to 4000 BC); Neolithic - (*circa* 4000 to 2400 BC); Bronze Age (*circa* 2400 to 500 BC) – Iron Age (*circa* 500 BC to AD 400)
2. **The medieval period:** Early medieval 5th – 12th century; high medieval 12th century – *circa* 1400; late medieval *circa* 1400 – 16th century.

Mesolithic and Neolithic

The earliest evidence for human colonisation and settlement in Ireland can be dated to 7000 BC, the Mesolithic Period. The people of this era were hunter-gatherers, entirely dependent on what food could be obtained through hunting and gathering, amongst other things, edible plants and shellfish. The transition of these early settlers from hunter/gatherers to a farming way of life in the Neolithic Period brought about more permanent settlements and a more complex and structured social hierarchy. There are no known archaeological sites dating to the Mesolithic or Neolithic Periods within the Study Area. The general lack of sites does not, however, mean that such early settlement and occupation were unknown to the region. Just outside and to the east of the mouth of Cork harbour a number of finds of flint scatters, some of which date to the later Mesolithic period have been found. Within the Study Area, a Neolithic polished stone axe almost 0.12m long was identified during monitoring of topsoil removal prior to the construction of the waste-water treatment plant at Carrigrenan, *c.* 800m across the harbour to the northwest of the proposed development site (Lane 2001). Including this find, a total of six Neolithic polished stone axes have now been recovered from the Cork Harbour area (*ibid*) while the Files of the National Museum give details of a dugout canoe that was washed ashore in the townland of Pembroke, Passage West across the harbour to the west of the proposed development site. Although this boat wasn't dated, it is typical of the earliest boats known to have been made by humans. These finds provide valuable evidence of human activity in the study area in the early prehistoric period.

Bronze Age and Iron Age

The Irish Bronze Age is characterised by the introduction of metallurgy to the Island of Ireland. The earliest recorded archaeological sites in the study area date to the Bronze Age in the form of six fulachtai fia, two (CO075-091 and CO075-092) in Foaty, one (CO087-125) in Ballynoe and three (CO075-035, CO075-036001 and CO075-036002) in Lissanisky. Fulachtai fia, which have been interpreted as cooking places, bathing places or steam baths ,are the most common type of prehistoric site in the country. The two fulachtai fia in Foaty were identified during pre-development testing of a proposed extension to Fota Wildlife Park. The fulacht fia in Ballynoe consisted of a kidney-shaped mound (18m E-W; 15m N-S) of heat-shattered stones and charcoal-enriched soil. The site is located within a housing estate and there are no visible remains of it (Ronan *et al.* 2009). There is a cluster of three fulacht fia in the same field in Lissanisky which consist as grass covered spreads of burnt material (Power *et al.* 1994). There are no known sites dating to the Iron Age within the study

area or surrounding landscape. However, finds such as the 'Cork Horns' discovered close to the jetties around Victoria Road in Cork City and dated to the 1st century AD (Rynne, 1993) are a clear indication of Iron Age activity in the Cork area.

Early Medieval Period

This period in Ireland is characterised by the influx and influence of Christianity, which had become widely established by the 6th century AD such as the ecclesiastical site (CO087-065002) on Spike Island, situated *c.* 5km to the southeast of Marino Point. Monasteries became a focal point for the lay communities of this period who were spread throughout the countryside in settlements such as ringforts/raths, crannogs and simple huts. Recorded archaeological sites dating to this period within the Study Area include three ringforts in Lissanisky, (CO075-033, CO075-034 and CO075-042). In addition, pre-development testing of a proposed extension to Fota Wildlife Park in Foaty townland was undertaken in 2012 and an oval enclosure (CO075-093) was identified (Quinn, 2012). One sherd of pottery was found from the surface of a charcoal-enriched spread and was identified as being from a late Roman amphora dating to the 4th – 7th century (*ibid*). There is one holy well (CO087-007) in Ballyleary. The tradition of visiting holy wells goes back to the very beginnings of Irish Christianity, but most wells probably have their origin in pre-Christian ritual activities. Some wells are still maintained for holy use when at certain times of the year they would be visited in the form of a pilgrimage often referred to as a 'round' or 'pattern'. According to Power (1918) rounds were made at the well in Ballyleary, particularly on Easter Sunday. The well is no longer in holy use (Power *et al.* 1994).

High Medieval and Late Medieval Periods

The majority of castles in Ireland can be broadly classified into two groups; the early castles of the late twelfth and thirteenth centuries and the tower houses of the fifteenth to seventeenth centuries. Tower houses consist of fortified residences in the form of a tower that was usually four to six storeys high and often partially enclosed by a bawn. Most tower houses date to the fifteenth/sixteenth centuries.

Within the Study Area, Belvelly Castle (CO075-030) is a four-storey tower house located on the north shore of Great Island overlooking the ford which was the only access to the island before Belvelly Bridge was built in 1803. The castle was restored in late 2018 and is currently in use as a private residence. Historical evidence also suggests that a second castle (CO75-065) was present in the townland of Oldcourt outside the proposed development site to the south but within the Belvelly Port Facility. There is an account of Hugh O'Neill raiding two castles in the NW corner of Great Island named as 'Shanecourt' and 'Killhodeneigue' which were both probably Hodnett castles (Power *et al.* 1994).

Post Medieval Period

Many of the archaeological sites within the Study Area date to the Post Medieval Period. They include Marino Country House (CO075-013) and Orangery (CO075-076), *c.* 250m to the south of the proposed development site. Also associated with Marino House was a demesne landscape feature (CO075-027), *c.* 180m to the south and a farm building (CO075-074), *c.* 210m to the southeast of the proposed development site. The designed landscape feature, a possible tennis court/garden feature dating from

the mid-20th century, was removed in the 1970's during the construction of the Irish Fertilisers Industries (IFI) complex while the farm building was demolished by CCC following a chemical spillage at the former NET plant (Archive Files NMS). The proposed development site was reclaimed from Cork Harbour in the 1970's during construction of the IFI complex. It lies just to the north of the former demesne lands associated with Marino House (CO075-013 and NIAH 20907585) which overlooks Cork Harbour on the south shore of Marino Point.

Philip Ronayne built a house at Marino Point in the early 18th century. The house, known as 'Ronayne's Grove' and later 'Marino' was described by Smith (1750) as a 'good house and handsome improvements'. This earlier house was burnt down in *c.* 1860 and was replaced by the current building, a 2-storey house with 3-sided bows (Power *et al.* 1994). The 1911 Census records nineteen rooms in the Marino House which was then occupied by Pascoe William Gampell Stuart (aged 42), his wife Elizabeth Julia Stuart (aged 42), their two children and five servants. Pascoe Stuart died at Marino House on the 5th of February 1954 aged 85 years (www.abandonedireland.com). The house is described as an *'imposing country house retaining its mid-nineteenth century character and form.....and exhibiting notable features including many fine timber sliding sash windows'* (NIAH).

Marino House is described in the NIAH (20907585) as follows;
Detached L-plan seven-bay two-storey country house, built c. 1870, with single-bay single-storey porch to front (south) elevation, canted bays to east and west elevations and wings to rear (north). Incorporating fabric of earlier dwelling. Now disused. Hipped slate roofs with rendered chimneystacks and cast-iron rainwater goods. Hipped slate roof to porch. Rendered walls with render stringcourse. Render corner pilasters to porch. Square-headed window openings to front elevation, round-headed window openings to porch and ground floor of canted bays, having cut limestone sills and margined one-over-one pane timber sliding sash windows, those to west canted bay having timber Y-tracery. Triple round-headed window openings to rear (north) elevation of main block having cut limestone sills and six-over-six pane timber sliding sash windows. Square-headed door opening to east elevation of porch having timber panelled door. Five-bay double-height bow-fronted orangery, built c. 1790, to east of site. Red brick construction having round-headed openings. Flanking lean-to glass houses to east and west'.

An orangery (CO075-076 and NIAH 20907585) of red brick construction, built *c.* 1790 is located a short distance to the east of the house within a walled garden. It has lean-to glass houses to its east and west. The walled garden has been breached at the northern end by the construction of a structure associated with the former IFI plant. The orangery was restored by IFI in the late 1970's when the land was purchased by the company, much of which was overseen by Professor Oliver Roberts of UCC who claimed that the nearest 18th century orangery using its original heating system was at the Schonbrunn Palace in Vienna. The orangery today appears to be in good condition with its roof intact.

There are five Martello towers in Cork Harbour, two of which (CO075-026 and CO075-029) in the townland of Belvelly are in the study area guarding the north side of Great Island. Martello towers were once part of an extensive network of similar towers erected on the English and Irish coasts as a defensive measure against a French invasion. They were built in Ireland by the military authorities

under the 'National Defence Act' of 1804. In total there were five towers built in Cork Harbour, three of which are on the Great Island of Cobh (Belvelly, Monning and Rosslague), one at Ringaskiddy and one on Haulblowline Island. All of the towers in Cork Harbour were completed and ready to be fitted with their guns by 1814 (McCarthy, C. 2019). The process of removing the guns from the towers commenced in 1868 after the Monning tower (CO075-026) was successfully raided by the Fenians in December 1867 (*ibid*).

10.2.2.1 Cultural Heritage

Cultural Heritage can be site specific, when an archaeological or architectural site has cultural heritage associations, or non-site specific, where less tangible aspects of cultural heritage cannot be pinpointed to a particular place but can be tied to a specific region. Our cultural heritage provides a link with our past, is part of our identity and who we are as a people and as a region. The Study Area, and its broader region, is steeped in a rich and varied tradition that is centred on its location as a peninsula adjacent to Cork Harbour.

There are no cultural heritage sites within the proposed development site. Six cultural heritage sites were identified within the Archaeological, Architectural and Cultural Heritage section of the EIAR for the Belvelly Port Facility demolition, site infrastructure and utility upgrade works (planning Ref. No. 19/6783).The closest of these to the proposed development site is the Cork to Cobh Railway line, located 40m outside to the east. The other five cultural heritage sites are surviving demesne features associated with Marino House (CO075-013; NIAH 20907585), located *c.*250m outside the proposed development site to the south.

The Cobh Branch of the Great Southern and Western Railway line (GS & W) is situated *c.* 40m outside the proposed development site to the east. During the 19th century, with the industrial revolution, there was an increase in production and a change in population shift with more people moving to towns and cities to work. The introduction of railway lines improved communication, shortened travel times and allowed for better trade and commerce. The railway line has, over the last century and a half, become an integral part of the local landscape and now plays a major part in the commuter value of towns like Cobh, *c.* 5km to the southeast of the development site.

The single track line was opened in 1862 and is still operational, heading east from Cork City with stops at Little Island, Glounthaune, Fota, Carrigaloe (situated *c.* 1km south of the proposed development site) and Rushbrook before terminating at Cobh. The line from Cork to Cobh crossed the Slatty and Belvelly viaducts which were originally of timber construction but were replaced by iron structures by the 1880's (Irish Railway Record Society). Slatty Viaduct carries the railway line over the channel that separates Haper and Fota Island while the Belvelly viaduct takes the line from Fota to Great Island. The Belvelly viaduct, detailed in the NIAH (20907591), is located c. 1.3km to the north of the proposed development site and is a triple span bridge built in 1882. The railway line is depicted on the OS 25 inch map and a siding from the main line, named the Belvelly siding is depicted outside the proposed development site to the north (**Figure 10.5; Appendix 10.2**). The siding is again depicted and named on the later OS 3rd edition map (1938) (**Figure 10.6; Appendix 10.2**). The tracks for the Belvelly sidings

have been lifted and are no longer visible. The railway line overtook the importance of the sea and the commercial use of Cork Harbour for export and import in the mid/late-19th century.

The proposed development is situated within the townland of Marino. The Irish landscape is divided into over 62,000 townlands and this system of landholding is unique in Western Europe for its scale and antiquity. Many townlands are pre-Anglo/Norman in origin and Irish historical documents consistently use townland names throughout the historic period to describe areas and locate events accurately in their geographical context. The townland names and boundaries were standardised across the country in the nineteenth century when the Ordnance Survey began to produce large-scale maps of the country. Townlands existed long before the parishes and counties. The original Irish names were eventually written down in anglicised form as they sounded to English court scribes. The social customs or history of the people who have lived in a particular place can also be reflected in the name of the townland. Many townlands throughout Ireland took their names from early habitation sites, both ecclesiastical and secular as is the case for both townlands within the proposed development site.

The proposed development site is in the parish of Clonmel and lies within the townland of Marino. The name Clonmel is Cluain meala in Gaelic meaning lawn or meadow of the honey. The placename 'Marino' dates to the late 18th century. The area was previously known as Hodnet's Wood in 1573 and was changed to Ronayne's Grove in the early 17th century (Landford, 2008). The west side of the townland of Marino extends to a point in Cork Harbour and is called Marino Point or Frenches Point after the proprietor of Marino House, Thomas French. The Celtic name for Marino Point is Point an Dúna, the Fort Point. According to John Hegarty, the name Dún was given to the conical hill immediately northwest of Marino House which of natural formation, may indicate an earthwork once existed here (Lankford, 2008). This area/hill was removed during the ground reduction to facilitate the construction of the IFI facility in the 1970s. There has been a country house on Marino Point from the early 18th century onwards and a description dating to the middle of that century records that the gardens of Ronayne's Grove commanded a "charming view of the river and shipping to Cork" (Smith 1750). Prior to the construction of the main Cobh road in the 19th century the only access by road to Marino Point was along an avenue extending westwards from the old Cobh road.

The nearest settlements to the proposed development site are Carrigaloe and Rushbrook, *c.* 1.3km and 3km to the south of the proposed development site, respectively while Passage West, lies c. 1km across Cork Harbour to the west.

10.2.2.2 Architectural Heritage

There are no protected structures listed in the Cork CDP within the proposed development site. The closest to the development site is Monning Martello Tower (RPS 01366) located *c.* 800m to the north. There are a total of seventeen structures listed in the NIAH within the vicinity of the proposed development site, only one of which, the Martello Tower is a protected structure. These buildings date from the early 19th century to the late early 20th centuries and are listed in **Table 10.2** and displayed on **Figure 10.3** below.

Table 10.2: NIAH sites within or in close proximity of the proposed development site

NIAH	RMP/PS	DESCRIPTION	TOWNLAND	DISTANCE
20907585	CO075-013	Marino House	Marino	250m to S
20907585	CO075-076	Marino Orangery	Marino	250m to S
20907586	None	Summerlea House 1910-1920	Donegal	750m to S
20907587	None	Bridge 1855-1865	Donegal	800m to S
20907588	None	House 1900-1920	Donegal	830m to S
20907591	None	Bridge 1870-1890	Belvelly	1.3km to N
20907592	CO075-026 PS 01366	Monning Tower – Martello Tower 1810-1815	Belvelly	800m to N
20908701	None	Arsutus, Marino Villas 1840-1860	Ballyleary	900m to S
20908702	None	Highleigh, Marino Villas 1840-1860	Ballyleary	900m to S
20908703	None	The Anchorage, Marino Villas 1840-1860	Ballyleary	900m to S
20908704	None	5 Marino Villas 1840-1860	Ballyleary	900m to S
20908705	None	Post Box 1922-1955	Ballyleary	900m to S
20908706	None	4 Marino Villas 1840-1860	Ballyleary	900m to S
20908707	None	Padova, 3 Marino Villas 1840-1860	Ballyleary	900m to S
20908708	None	Carrigaloe Railway Station 1860-1865	Ballyleary	1km to S
20908709	None	Footbridge - Carrigaloe Railway Station	Ballyleary	1km to S
20908710	None	Station Masters House	Ballyleary	1km to S

Figure 10.3 Proposed development site outlined in red within the Belvelly Port Facility outlined in blue showing NIAH sites located adjacent to the proposed development site5

The proposed development site lies at the northern end of the Marino Peninsula which was at one time part of Cork Harbour. This area was reclaimed post 1938, probably in the 1970's during the construction of the IFI plant. Marino House (CO075-013; NIAH 20907585), orangery (CO075-076; NIAH 20907585) and associated demesne lands lie outside the proposed development site to the south.

Summerlea House, situated *c.* 750m to the south of the development site is listed in the NIAH (20907592), and described as follows; *'Detached U-plan three-bay two-storey house built c. 1920, having central gablet and gabled projecting porch flanked by verandah supported by carved timber*

[5] www.archaeology.ie

columns to front (west) elevation (NIAH). Flat-roofed extensions to the rear. Now disused'. A site inspection of the development area on the 26th of June 2019, noted that the house is roofless and in a ruinous condition. Approximately 150m to the south of Summerlea House, there are six houses grouped in pairs overlooking the harbour, collectively known as Marino Villas. This group of six houses, dating between 1840-1860, are similar in design with their front elevation to the shoreline. All of the houses retain notable features and much of their original form and fabric (NIAH).

The Cobh Branch of the Great Southern and Western Railway line (GS & W) (described in section 10.2.2.1 above) is situated *c.* 40m outside the proposed development site to the east.

To the south of the proposed development site is Carrigaloe Railway Station which contains three structures associated with the railway; Carrigaloe Station (NIAH 20908708), footbridge (NIAH 20908709) and station cottage (NIAH 20908710). Carrigaloe Station consists of a detached three-bay structure built in 1862 with a gable projecting bay to the front and slate roof. The building, now disused, forms a group with the station masters house (20908710), adjacent footbridge (20908709) and railway bridges further south. The red brick construction and gabled form are typical of railway structures of the era (NIAH). The station masters house is a detached three-bay structure built in 1862 and has a recent three-bay single storey extension attached to the north elevation. It is now in use as a residence. The footbridge consists of a single-span cast iron pedestrian bridge over the railway line.

There are two other bridges listed in the NIAH just outside the development site, to the north in Belvelly (20907591) (described above) and the south in Donegal (20907587). The bridge to the south is a single-span railway bridge, built c. 1860, and carries the railway line over the road. The bridge was altered in *c.* 1880 with the addition of a double track metal deck. According to the NIAH, the bridge, like the other railway structures serve as a reminder of the engineering achievements of the 19th century and add significantly to the architectural heritage of the area.

10.2.3 Cartographic Sources

The following maps were consulted: These are reproduced in **Appendix 10.2.**

- Candell's Map of Cork Harbour (1587);
- Down Survey Parish and Barony maps (1654-1659);
- The 1811 Grand Jury map of Cork compiled by Neville Bath in the 1790s and published in 1811 at a scale of three quarters of an inch to one mile;
- 1:50,000 OSI Discovery Series;
- Ordnance Survey (OS) 6-inch maps; the three editions of the 6-inch to one mile scale maps were consulted, the first edition published in 1841-1842, the second edition published in (1897-1904), and the third edition published in 1938;
- The 25-inch to one mile scale map, from which the second edition 6-inch map was derived in 1902.

A small number of later medieval and post medieval maps of the harbour were consulted. The earliest of these is Candell's map of Cork harbour, dated to 1587, which depicts Belvelly Castle (CO075-030), situated *c.* 1.6Km to the northeast named *'Belville'* (**Figure 10.1; Appendix 10.2).** The Down Survey Map of 1654-1659 of the parish of Clonmel depicts three houses in the vicinity of Marino and Oldcourt townlands (**Figure 10.2; Appendix 10.2).** The Grand Jury Map of 1811 depicts a house on the Marino Peninsula and a house in the townland of Oldcourt to the south (**Figure 10.3; Appendix 10.2)**.

The three editions of the Ordnance Survey (OS) maps (6-inch map of 1841, 25-inch map of 1902 and 6-inch map of 1938) (**Figures 10.4-10.6; Appendix 10.2),** all depict the proposed development site as being part of Cork Harbour. The area of the proposed development site, lying off the northern shore of the Marino Point peninsula, is labelled 'mud' on all of the three OS map editions. Marino House (CO075-013) and Orangery (CO075-076) are depicted on all three OS map editions at the southern end of the Marino peninsula within a demesne of landscaped gardens and pathways. Outside the proposed development site to the north, the OS 6 maps depict a narrow spit of land extending northwards from Marino Point peninsula into Cork Harbour with 'muds' on either side. At the very northern extent of the spit, the Martello tower (CO075-026 & PS 01366), known as Monning Tower, is depicted and named. The Great Southern and Western Railway Line' is depicted running to the east of the proposed development site on the 1902 25 inch and the 1938 6 inch maps.

10.2.4 Site Inspection

The proposed development site was visited on the 22nd of January 2020 in dry and bright weather conditions. The primary purpose of a site inspection is to assess the physical environment in which the development will be undertaken and to identify any possible features of cultural heritage significance which have not been previously recorded. Current land use, local topography and environmental conditions are assessed to gain an overall picture of the area.

The Marino Peninsula is located within Cork Harbour where there is a wealth of recorded archaeology. Harbours and tidal estuaries are known as areas where archaeological finds such as fish traps, boats and various items have been found in the past. Given that the proposed development site lies on what was mud until the last century it is possible that archaeological finds or features may exist in the undisturbed muds beneath the reclaimed overburden.

10.2.5 Fieldwork Results

The proposed development site lies at the northern end of Marino Point peninsula and was reclaimed from Cork Harbour, in the 1970's during construction of the IFI complex. It is a brownfield site comprising an upstanding factory building, the remains of a second building to the southwest, internal roads and car parking areas associated with the former IFI complex (Fig. 10.4). The original northern shoreline of the Marino peninsula, depicted on all three editions of the OS maps (**Figures 10.4-10.6; Appendix 10.2)** is roughly delineated by a line of mature palm trees bordering the proposed development site to the south. No finds or features of an archaeological, architectural or cultural heritage nature were noted.

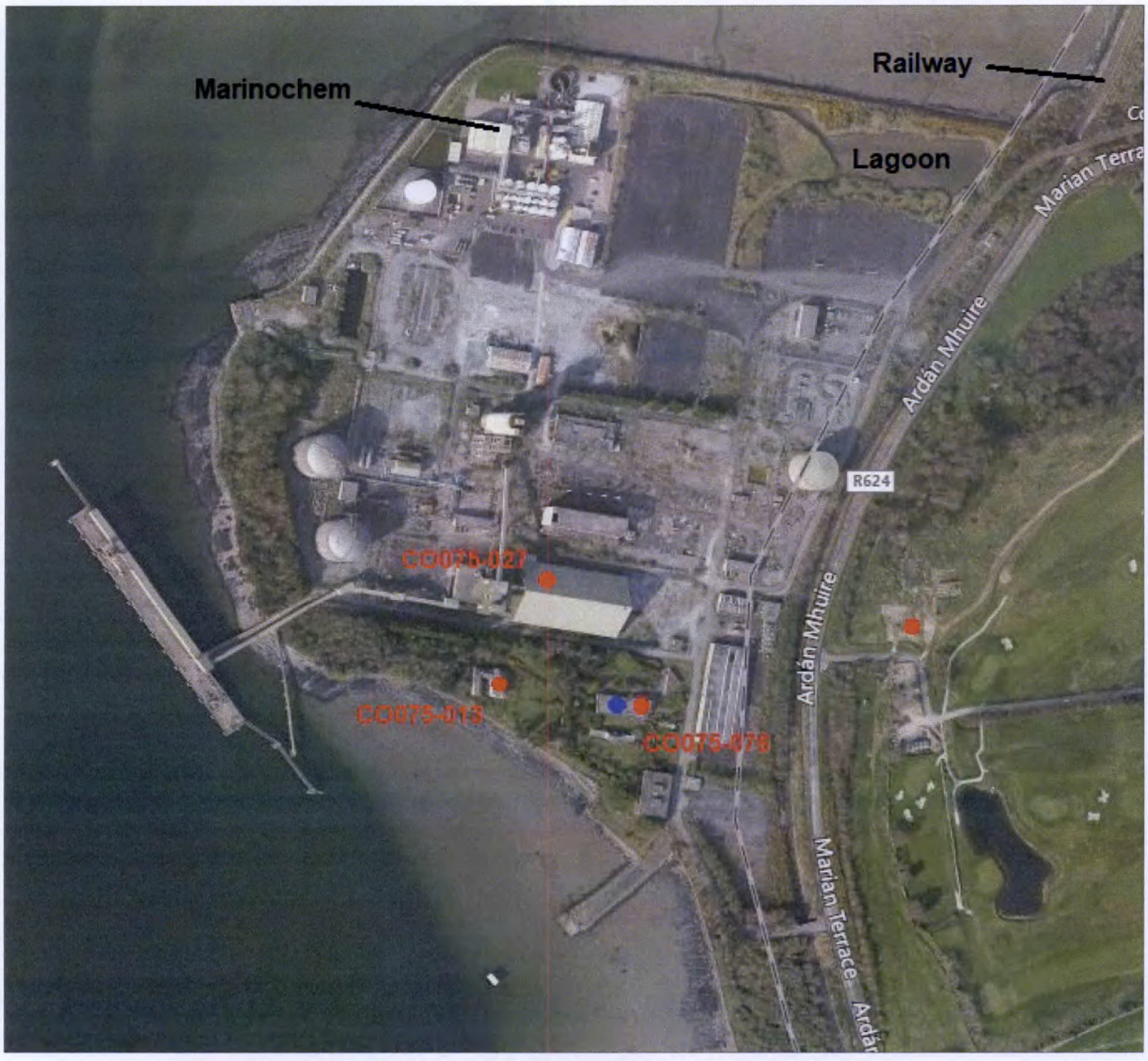

Figure 10.4: Proposed development site on aerial photo

10.2.6 Do-Nothing Scenario

If development does not proceed, the existing landscape will remain in its current condition with potential subsurface archaeological sites/features concealed beneath the surface.

10.3 Likely Significant Impacts

10.3.1 Likely Impacts on the known recorded archaeology unknown archaeology or wider cultural heritage

10.3.1.1 Construction Phase

The proposed Goulding fertiliser facility lies within the Belvelly Port Facility site at the northern end of the Marino peninsula. Goulding are proposing to construct a new agricultural fertiliser facility on the site. The northern end of the peninsula was reclaimed post 1938 and contains the operational

Marinochem Plant, carparking areas and a manmade lagoon at the northeast corner. The area was probably reclaimed during construction of the former IFI site in the 1970's. It is possible that hitherto unknown archaeological finds or features may be present in this area in the original mud flats that lie beneath the reclaimed overburden. Geotechnical Investigations undertaken in this area confirm that the reclamation material is at a depth of 2.5m.

As detailed in **Chapter 2 Description of the Proposed Development** the final details on how construction on the proposed development site will be undertaken will be a decision for the appointed contractor(s). Construction methods will, however, include the following:

- Piling using CFA piles
- Excavation for underground utilities

Given the ground conditions on site, piled foundations will be required for the proposed buildings (outlined in orange on **Figure 10.4** above). Excavations to a depth of 1-3m below ground level will be required in certain areas for the installation of the necessary services (i.e. drains, fibre etc).

There will be no construction impacts associated with the proposed additional port operational uses to facilitate cargo vessels.

10.3.1.2 Operational Phase

No direct significant operational impacts on archaeology, architecture and cultural heritage as a result of the operational phase of the proposed Goulding agricultural fertiliser facility are envisaged.

No direct significant operational impacts on archaeology, architecture and cultural heritage as a result of the additional port operational use to facilitate cargo vessels at the jetty are envisaged.

10.3.1.3 Do-Nothing Scenario

If development does not proceed the existing landscape will remain in its current condition with potential archaeological finds or features beneath the reclaimed ground in the underlying original mud flats.

10.3.2 Cumulative Impacts

The proposed development site (approximately 7.6 hectares) lies within the Belvelly Port Facility at the northern end of the Marino peninsula.

As part of the redevelopment of the Marino Peninsula, the proposed demolition, site infrastructure and utility upgrade works (planning Ref. No. 19/6783) will prepare the site for future use by BMDC and third parties. These works will consist of the demolition and removal of all existing super structures, sub-structures, foundations and existing services. Once complete, the development will be a serviceable site with new infrastructure and utility upgrades, on which new development projects can be established.

When the cumulative impacts of the demolition, site infrastructure and utility upgrade works (planning Ref. No. 19/6783) works and the proposed new development projects are considered, no

significant cumulative effects are predicted on Marino House, orangery and surviving demesne features at the southern end of the Marino Peninsula.

Construction work for the Goulding facility will involve large-scale ground reduction which would have a moderate cumulative impact on any potential archaeological material that may survive below the surface in the underlying muds beneath the reclaimed overburden.

10.3.3 Visual Impact

Marino Point has a long and well established industrial history. The site has been historically used for docking ships and the loading/ unloading of cargo since the late 1970s. The former owners, IFI began operating in the early 1970's and ceased operation in 2002. The construction of the IFI plant in the 1970s had a significant effect on the setting of Marino House and demesne. The construction of the industrial IFI facility within the parkland associated with Marino House, irreversibly altered its setting.

The proposed development site will not visually impact on Marino House (CO075-013) and Orangery (CO075-076), located at the southern end of Marino peninsula. The mature vegetation to the north of Marino house significantly mitigated the visual impact of the industrial complex of the former IFI plant on the house, orangery and the extant demesne features and their setting. As a consequence, the buildings associated with the proposed development will be screened from Marino House and Orangery and will have no impact on views both to and from the house.

The proposed development will be in keeping with the historical and existing industrial use of the site which was established in the 1970's while the Marino House, orangery, walled garden and extant demesne features will remain intact within this larger industrialised landscape.

10.4 MITIGATION

The entire proposed development site is brownfield and was reclaimed during construction of the former IFI site in the 1970's. It is possible that archaeological finds or features may be present in this area beneath the reclaimed overburden in the original mud flats. Geotechnical Investigations undertaken in this area confirm that the reclamation material is at a depth of 2.5m.

Mitigation

Intermittent archaeological monitoring will be carried out on the site during construction. Archaeological monitoring will be focussed on those areas where the installation of necessary underground services (drains etc.) will exceed the depth of fill material. The areas to be archaeologically monitored will be established in advance by the appointed archaeologist when the full construction details are in place.

10.5 RESIDUAL IMPACTS

No residual impacts on the archaeological, architectural and cultural heritage environment are foreseen.

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